



PLA Naval Aviation Training and Operations

Missions, Organizational Structure, and Training
(2013 - 15)



Kenneth Allen and Lyle J. Morris

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Preface

This report was first presented at the 2016 China Aerospace Studies Institute (CASI) conference sponsored by Headquarters, U.S. Air Force, at the RAND Corporation's office in Arlington, Virginia. Many experts on Chinese airpower, military operations, and Chinese military modernization participated in the conference, provided research, and gave valuable feedback. This report draws on that information and assess significant developments in, and implications of, China's emerging aerospace field and power projection capabilities. As China's economic, diplomatic, and security interests continue to expand, the People's Liberation Army (PLA), and in particular its aerospace forces—to include the PLA Air Force (PLAAF), PLA naval aviation, and PLA space capabilities—will continue to push to develop or acquire more robust power projection and expeditionary capabilities, commensurate with China's expanding global interest. In addition to traditional security concerns, like Taiwan and maritime territorial disputes, issues such as countering terrorism, humanitarian assistance/disaster relief (HA/DR), and sea-lane protection have now become factors in the PLA's training, doctrine, and modernization efforts. This report examines the roles, missions and developments in training within the People's Republic of China's (PRC) People's Liberation Army Navy's (PLAN) Naval Aviation Branch.

With this, our second published volume, CASI continues to expand the understanding of the PLA's aerospace forces. While primarily focused on developments related to the services and branches of the People's Liberation Army's aerospace assets and forces, CASI will also explore topics and areas related to the support

infrastructure, industrial base, and civil-military integration, that combines together to form the overall China aerospace field.

We hope you will find this volume useful and timely, and welcome any feedback on its contents, or suggestions for further or future research in this field.

Dr. Brendan S. Mulvaney
Director, China Aerospace Studies Institute

Author Profiles

Ken Allen is the Research Director for the US Air Force's China Aerospace Studies Institute (CASI). For the past 25 years, his primary focus has been on China's military organizational structure, personnel, education, training, and foreign relations with particular emphasis on the PLA Air Force. During 21 years in the U.S. Air Force (1971-1992), he served as an enlisted Chinese and Russian linguist and intelligence officer with tours in Taiwan, Berlin, Japan, PACAF Headquarters, China, and Washington DC. From 1987-1989, he served as the Assistant Air Attaché in the U.S. Embassy in Beijing. He has B.A. degrees from the University of California at Davis and the University of Maryland and an M.A. degree from Boston University. He has written multiple books, monographs, chapters, journal articles, and online articles on the PLA.

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Abstract

This report examines the roles, missions and developments in training within the People's Republic of China's (PRC) People's Liberation Army Navy's (PLAN) Naval Aviation branch. Naval Aviation provides the PLAN with its own air capability independent of the PLA Air Force (PLAAF). Historically, Naval Aviation fighters have intercepted aircraft along China's coast but have not provided air cover for naval ships at sea, and fighters still rarely provide air cover for at-sea vessels. However, Naval Aviation's role is being increasingly transformed to include maritime patrol, anti-submarine warfare (ASW), offensive strikes against land targets and ships at sea, logistical support, airborne early warning (AEW), and helicopter support for the PLAN's escort task forces in the Gulf of Aden. Naval Aviation remains a largely land-based force, though the PLAN's increasing fleet of destroyers, frigates, landing ships and replenishment vessels are equipped with shipborne helicopters for operational and logistics air requirements. The much anticipated and speculated-about Chinese aircraft carrier program will impart an altogether new dimension to Naval Aviation as it seeks to operate farther offshore, to protect Chinese interests abroad; however, the PLAN is many years away from integrating a viable carrier component into its overall naval strategy.

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Summary

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The first section begins by providing a brief overview of Naval Aviation's history, missions, tasks, and responsibilities, as well as its organizational structure. The remaining sections examine training from 2013 through 2015, inclusive, for each component of Naval Aviation, including fighters, fighter-bombers, bombers, AEW aircraft, and helicopters. It then looks at Naval Aviation training in terms of combined-arms training with other PLAN branches (surface, subsurface, and coastal defense), joint training with the

PLA Army (PLAA) and PLA Air Force (PLAAF), and combined training with foreign militaries. The penultimate section examines carrier-based aviation training and development. The final section provides an overall assessment of Naval Aviation training and operations.

Abbreviations

ADIZ	Air Defense Identification Zone
AEW	Airborne early warning
AEW&C	Airborne early warning and control
ASuW	Anti-surface warfare
ASW	Anti-submarine warfare
ATC	Air traffic controllers
AWACS	Airborne warning and control system
BVR	Beyond-visual-range
CATOBAR	Catapult assisted take-off but arrested recovery
CEME	Complex electromagnetic environment
CVBG	carrier battle group
ESF	East Sea Fleet
FCLP	field carrier landing practice
MRAF	Military Region Air Force
NATOPS	Naval and Air Training and Operating Procedures
NSF	North Sea Fleet
OOS	Operation Open Shield
PLAA	PLA Army
PLAAF	PLA Air Force
PLAN	People's Liberation Army Navy's
PRC	People's Republic of China's
SAM	Surface-to-air missile
SLOC	Sea line of communications
SSF	South Sea Fleet
STOBAR	Short take-off but arrested recovery
UAV	Unmanned aerial vehicles

1. Overview

Laying the Foundation for the Naval Aviation Branch

Following its establishment on 23 April 1949, the People's Liberation Army Navy (PLAN) promulgated its first three-year plan.² On 1 August 1952, the PLAN officially created the Naval Aviation branch, which is always listed third in protocol order among its five branches (submarines, surface vessels, aviation, Marine Corps, and coastal defense), with a headquarters in Beijing.³ The portions of the initial three-year plan that pertained to creating a Naval Aviation (海军航空兵 / 海航) branch (兵种) included: 1) establishing three air divisions (one aerial mine-laying bomber division, one fighter division, and one division consisting of two ground attack regiments and one fighter regiment); 2) establishing three aviation schools, which would train 10,000 pilots and ground support personnel; 3) building two to three Naval Aviation airfields in each strategic combat area; and 4) purchasing 361 aircraft and necessary support equipment from the Soviet Union. In 1955, the PLAN adjusted its surface fleet by establishing the North Sea Fleet (NSF / 北海舰队), East Sea Fleet (ESF / 东海舰队), and South Sea Fleet (SSF / 南海舰队), each of which had a subordinate Naval Aviation Headquarters.⁴ All of the Naval Aviation units that had been created were then assigned to the appropriate fleet or were directly subordinated to Naval Aviation Headquarters. In November 2003, the PLAN abolished its Naval Aviation Headquarters in Beijing and created a Naval Aviation Department under the PLAN Headquarters Department; however, it retained each of the three fleet Naval Aviation Headquarters, where each of the three commanders serves as a concurrent fleet deputy commander.⁵

Historically, Naval Aviation and the PLAAF have had different cultures, even though, until the early 2000s, the PLAAF trained

Naval Aviation fighter and attack pilots. Whereas the aviation branch is the most important of the PLAAF's five branches, Naval Aviation has always been listed third behind the surface and subsurface branches, and has not received as much attention as them. Even though the PLAAF and Naval Aviation have historically been organized into air divisions and regiments, as discussed in this chapter, Naval Aviation occasionally mixes different airframes. Furthermore, whereas the PLAAF began creating air brigades in 2012, Naval Aviation apparently has not created any air brigades. In addition, whereas the PLAAF has been shifting at least some of its commanders from the top of the control tower to the command post in the bottom of the control tower, Naval Aviation has apparently not followed suit. Finally, as noted in the chapter, Naval Aviation and the PLAAF rarely train together.

Naval Aviation Missions, Tasks, and Responsibilities

According to China's 2002 and 2012 Defense White Paper, respectively, "The PLAN's primary missions are, independently or jointly with the Army and Air Force, to guard against enemy invasion from the sea, defend the state's sovereignty over its territorial waters, and safeguard the state's maritime rights and interests" and "Is China's mainstay for operations at sea that is responsible for safeguarding its maritime security and maintaining its sovereignty over its territorial seas along with its maritime rights and interests."⁶

Within the PLAN's overall missions, Naval Aviation's primary mission is to carry out combat tasks at sea and coastal airspace with naval aircraft as its primary equipment.⁷ It has the ability to conduct long-range operations, high-speed mobility, and attacks, and independently carry out multiple types of combat missions.⁸ Naval Aviation's areas of responsibility (AORs) include both coastal and maritime domains, with an emphasis on the maritime sphere.⁹ Overall, Naval Aviation's mission is composed of several tasks that include protecting the maritime and maritime airspace domain

through offensive strike, air defense, maritime reconnaissance and patrol, anti-submarine warfare (ASW), and anti-surface warfare (ASuW).¹⁰ As Naval Aviation continues to acquire aircraft with greater ranges and endurance, PLAN official reporting have added blue water (大洋) operations to Naval Aviation's list of responsibilities, as well.¹¹

According to the 2001 and 2006 *Science of Campaigns*, one of the main missions for the PLAAF and Naval Aviation is to conduct advanced minesweeping and obstacle clearing by executing key-point destruction of anti-amphibious-landing obstacles laid by the enemy in the surf zone and on the beachhead, so as to reduce the density of the obstacles, in order to create the conditions for follow-on direct destruction of obstacles.¹² Specifically, air assets would use air-dropped demolition bombs to destroy enemy obstacles along the surf zone and on beaches, and they should carry out focused bombing against fortified obstacles, such as tracked bulwarks and blocking walls. However, this assumes a permissive environment for aircraft, which will most likely not be the case.

Functional Components of Naval Aviation

Besides its aviation component consisting of aircraft, helicopters, and airfields, Naval Aviation, like the PLAAF, has subordinate surface-to-air missile (SAM), antiaircraft artillery (AAA), radar, communications, chemical defense, aircraft maintenance, and logistics units, as well as various academic institutions. Today, each of China's three fleets has one Naval Aviation radar brigade, while the NSF is the only fleet whose Naval Aviation component has a combined-arms air defense brigade consisting of SAMs, AAA, and radar stations. Although Naval Aviation originally had subordinate SAMs, it apparently divested itself of any SAM units in the late 1980s, but it is not clear what happened to the units. By late 2014, however, the NSF's Naval Aviation had re-incorporated SAMs along with its existing AAA regiment and radar stations into a

combined-arms air defense brigade.¹³ No SAM units have been identified under the ESF's or SSF's Naval Aviation. In addition, the PLAN's coastal defense branch apparently created an air defense brigade consisting of AAA, SAMs, and radar in the SSF around 2012 (See Appendix A).

Naval Aviation Aircraft Training

The following sections address training by each of the aircraft components of Naval Aviation, including fighters, fighter-bombers, bombers, airborne early warning (AEW) aircraft, helicopters, seaplanes, and unmanned aerial vehicles (UAV). It is important to note, however, that each component is organized similarly. Therefore, the following section discusses commonalities that can apply to all components.

Key Personnel Terminology

The PLAN naval aviation branch uses military terminology in Chinese language similar to that found in the "PLA Army Aviation" PLAAF but with subtle differences, thus requiring a brief overview for the reader. First, like most air forces, Naval Aviation and the PLAAF use the general term "aviator" (飞行人员 and 空军) to refer to fighter, attack, helicopter, bomber and transport pilots, as well as bomber and transport flight crew members, including navigators, communicators, gunners, and maintenance personnel.¹⁴ Naval Aviation and the PLAAF use the term "pilot" (飞行员) to refer specifically to someone who flies the aircraft; however, the term is also used generically, to refer to all aircraft crewmembers. Therefore, when examining the recruitment, education, and training for "aviators" or "pilots," it is important to understand whether these terms refer to specific personnel or all of the crew members.¹⁵

Although very few articles found identified the lead pilots (长机) of a two-, three-, or four-ship formation (编队), it is not uncommon

for the division commander (师长) or one of the deputy division commanders (副师长), or the regiment commander (团长) or one of the deputy regiment commanders (副团长) to be the lead pilot for the flight formation.¹⁶ Normally, however, the battalion-level flight group commander (大队长), one of the flight group deputy commanders (副大队长), or one of the squadron-level flight squadron commanders (副中队长) serve as the lead pilot. It is also not uncommon for the regiment, flight group, and flight squadron commanders and deputy commanders to fly as a wingman for a younger pilot who is training to become a lead pilot. The reason for this, is that all pilots must also serve as an instructor pilot at each level as they move up the grade ladder. As a general rule, flight squadron commanders are second-grade (二级) pilots, flight group deputy commanders and commanders are first-grade (一级) pilots, and regiment deputy commanders and above are special-grade (特级) pilots.¹⁷

Other flight crew members include a co-pilot, navigator, radar operators, and communications personnel.¹⁸ The navigator in all two-seat fighter-bombers and bombers is responsible for pressing the bomb release buttons.¹⁹

Naval Aviation and the PLAAF use the term “airborne commander” (空中指挥员) in two different ways. First, he is the lead pilot for aircraft flying together in a two-ship formation. Second, he is the single officer on an AEW aircraft that is serving as an airborne command post who provides guidance to combat aircraft in the air.

During a training day, a typical control tower is manned by up to twelve officers. The term flight commander (飞行指挥员) refers to the three senior officers in the control tower who serve as air traffic controllers (ATC) and aircraft command and guidance (指挥引导) controllers for air engagements.²⁰ As shown in the photo below, the senior flight commander in the control tower is normally the regiment commander, one of the two to three deputy commanders, or the chief of staff (e.g., the director of the

Headquarters Department).²¹ Other key personnel in the tower include navigation and communications directors.²² Depending on the situation, the regiment's political commissar can also be in the tower.²³

Figure 1: Air Traffic Controllers



Source: *Navy Today*, October 2014, p. 42.

Each of the three flight commanders wears an arm patch with the characters for flight commander. Although the PLAAF began moving these officers in some, but not all, units from the top of the control tower to the command post in the bottom of the tower in 2012 and replacing them with other officers identified as “flight adjusters” (飞行调配员), it does not appear that Naval Aviation has followed suit. As such, the senior flight commander still controls virtually all Naval Aviation flight activity from takeoff to landing. It is not clear why Naval Aviation has not followed suit with the PLAAF or why not all PLAAF units have made the transition.

Upon receiving an order from the flight commander in the tower, the aircraft take off in succession, join up at a predetermined location, and then depart as a flight formation for their strike mission under radio silence.²⁴ At some point after the formation arrives over water, it descends to very low altitude before it approaches its target.

Prior to 2012, PLAAF and Naval Aviation pilots also received their flight plans from a staff officer in the regiment headquarters. As early as mid-2010, the PLAAF began experimenting with the concept of what it calls pilot autonomy (自主), which focuses on two of the pilot's three-phase training mission—creating their own flight plan and conducting techniques/skills training in the numbered flight zones without guidance from the control tower. However, it was apparently not fully implemented throughout the PLAAF until 2012. Since 2012, individual PLAAF units have slowly begun to implement the pilot autonomy program. Naval Aviation apparently began implementing various components of pilot autonomy as early as 2013, when it received its first J-10 unit.²⁵ It appears that some PLAAF and Naval Aviation units are still in the implementation phase of this program.

Challenges for Flying over Water

Naval Aviation and the PLAAF break the day into three flying periods: day (0800-1600), day into night (1600-2400), and after midnight (2400-0800). During the 2000s, they instituted “large flying periods” that move from day into evening, evening into after midnight, and after midnight into day.²⁶ They also began conducting what they referred to as “rolling-type” training that can last up to 24 hours and transitions through all three flying periods. That said, for the sake of safety, most Naval Aviation training was often conducted before nightfall. Pre-flight support for the bombers all took place in daytime or under bright lights. That practice inherently limited and lowered the standard of training. In 2015, Naval Aviation regarded highly difficult and dangerous training topics, such as night training, as playing the main role in actual combat (实战) training.²⁷ Although no official PLA definition was found for actual combat, the term has been used since the late 1990s and basically refers to conducting unscripted training in all weather conditions, at all times

of the day and night, under complex electromagnetic environment (CEME) conditions, and, for aircraft, at all altitudes and over water.

Naval Aviation is also conducting more long-distance sorties over water at what it calls very-low or extreme-low altitude, which it defines as less than 100 meters, and low altitude, which it defines as 100 to 1,000 meters.²⁸

Naval Aviation has acknowledged that it faces several problems in conducting long-range, over-water training, especially at night. Specifically, it is under pressure to conduct all training to high safety standards, but, in order to conduct training under actual-combat conditions, it must deal with fast changes in weather conditions, great difficulties in organizing training, and the exhausting effects of crew member biological clocks being upside-down during night training.²⁹

In addition, when flying at night over water at very-low altitude, the sky is pitch-dark and there are few visual references, which means an aviator can easily misperceive where he is.³⁰ As a result, the danger and difficulty coefficients are high.

Over the past couple of years, Naval Aviation has been trying to change its training from what it calls the “nanny style” mode of command, where flight, navigation, and communication directors kept watch from the control tower, to a new model, where the aircrews participating in the training now have a free hand to penetrate defenses, attack, and cope with danger on their own, based on the training topic and the battlefield situation.³¹

Multiple Types of Aircraft at the Same Airfield

From 2008 through the end of 2013, an unidentified airfield in the East Sea Fleet conducted more than 50 major training events and exercises that involved up to five different airframes, including helicopters, UAVs, transport aircraft, reconnaissance aircraft, and different models of fighters.³² For example, in August 2011, the airfield supported three different regiments with several dozen

aircraft of five different models during a joint exercise. One of the biggest challenges involved changing the entire logistics and maintenance support system since 2008, when the airfield supported only one model of aircraft. To accomplish this, the airfield station increased its personnel and facilities, as well as implementing better information technology systems to monitor maintenance. As a result, the airfield station was reportedly able to shorten the aircraft preparation time for re-dispatch by nearly 20 minutes, compared to its historical capability.³³

Yet another challenge was assigning airspace to different types of aircraft at the same time. To accomplish this, the airfield established the principle of “fighter first, transport aircraft later; flight for battle first, flight for other purposes later; support for the one who takes off first.” This involved methods of refueling in advance for first-time dispatch, combination of aircraft towing and taxiing, orderly ammunition extraction, refueling, inflation, power-on, and parachute packing, as well as resupply based on circumstance, thus shortening the ground support time and overcoming the tendency in ground support towards chaos and inefficiency.

A similar situation has occurred with the SSF’s 9th Air Division on Hainan Island, where one airfield can now support approximately 20 different types and models of aircraft.³⁴ Over the past few years, the daily average capacity of the airfield has been five times greater than that of similar airfields. During an exercise in January 2014, the airfield supported over 50 AEW aircraft, fighters, bombers, and helicopters at the same time, including up to 50 alert launches by as many as 10 different models.

Training from other Airfields

Naval Aviation has gradually increased its ability to deploy aircraft to other airfields in order to replenish the aircraft either before engaging the enemy or after concluding their missions, in contrast to an historical pattern of operating aircraft exclusively

from their home airfield, which was based primarily on the lack of a flexible logistics and maintenance support system. In addition, some aircraft often deploy to different airfields to conduct their intercept missions. For example, in April 2013, several aircraft from an ESF regiment deployed to a different airfield in another province.³⁵ Shortly after arriving, two of the aircraft were scrambled to conduct a combat patrol mission. Meanwhile, ground crews immediately started circuit checks, air and fuel services, and data calibration on two additional aircraft, rapidly completing preparation for another deployment. At the same time, the command group in the control tower held a brief meeting, transmitted air and sea situation reports, clarified the situation, and arranged unidentified missions.

In addition, as noted in Section 12, Naval Aviation aircraft have also flown out of PLAAF airfields, as occurred during the first free air combat (自由空战) mission, in August 2014.³⁶ Although no official definition was found, a review of multiple references indicate that free air combat involves conducting air-to-air engagements in specified airspace without strict guidance from the flight commander in the tower. So far, the focus in open source reporting has been on one-versus-one similar and dissimilar aircraft engagements.

Training in a Complex Electromagnetic Environment

Almost every Naval Aviation article states that its components engage in simulated or realistic jamming and counter-jamming under CEME conditions on a regular basis. As the fighters, fighter-bombers, AEW aircraft, and bombers approach their seaborne or land-based target, they engage in electromagnetic jamming and counter-jamming of radar, communications, and guided missile systems.³⁷ Besides the aircraft, various land-based radars and ground-based command posts also receive electromagnetic jamming from land-based, sea-based, and airborne jammers.³⁸ To counter the jamming, the aircraft commander issues an order to initiate the counter-jamming mode, which included synchronizing times,

comparing wavelengths, and organizing networks.³⁹ When the aircraft began to receive jamming, the navigator initiates infrared jamming.

As the aircraft approach the “enemy” surface vessels, land-based targets, or fighters, and the “enemy” radars have already locked onto them, the pilot or navigator counters by pressing a button to release jamming projectiles.⁴⁰

Although *Renmin Haijun* articles for just about every training event and exercise involve some type of jamming and counter-jamming, it is not clear how much is simulated and how much is real. Inevitably, the “Red Force” overcomes the jamming and is able to successfully complete its mission.

Crashes

Over the years, several Naval Aviation aircraft have crashed during training, primarily from aircraft malfunctions. For example, on 17 December 2015, a two-seat J-10 from the ESF’s 4th Air Division crashed without any damage to civilian personnel or property inside Zhejiang Province near Taizhou City while conducting night flight training.⁴¹ According to press reports, the aircraft spun out of control because of a malfunction owing to frequent night training and problems dealing with the Russian-made engine. Both pilots ejected safely.

In addition, on 11 May 2016, a Naval Aviation fighter crashed in Taizhou, Zhejiang Province.⁴² The crew ejected safely, but the aircraft crashed into a factory with no casualties.

Summary

As discussed in this section, Naval Aviation has been moving forward in many ways concerning its over-water training, training multiple airframes on one airfield, and training under CEME conditions on a regular basis. Even though it continues to face these

constraints, Naval aviation pilots fly out of multiple airfields. As a result, multiple airfields are successfully dealing with the logistics and maintenance issues concerning having more than one airframe, and aviators are training more often under actual and simulated CEME conditions.

Of note, a review of the research material for this paper found only a few references to ASW training by 1) reconnaissance aircraft, 2) shipborne and land-based helicopters and SH-5 seaplanes that include dipping sonars into the water and firing air-launched antisubmarine torpedoes, and 3) JH-7 fighter bombers that fire torpedoes. Weather and sea conditions are always a key factor in whether the helicopters can perform their missions. Although the PLAN rarely uses the term sea line of communications (SLOC / 海上交通线), as discussed later in the paper, various naval aviation aircraft do conduct patrol and strike missions to protect what can be considered China's SLOCs, including ASuW missions. The next section takes a closer look at the individual types of training by fighter pilots.

2. Naval Aviation Aircraft Training

The following sections provided fairly detailed information about Naval Aviation, fighter, fighter-bomber, bomber, and helicopter training. The key issues and themes of the analysis are as follows 1) Naval Aviation has the same types of combat aircraft as the PLAAF and is becoming a much more capable force; 2) Naval Aviation now has a dedicated “Blue Force” unit; 3) Naval Aviation is conducting long-range missions that occasionally use more than one airfield; 4) lead pilots continue to receive guidance from the unit commander in the control tower or an airborne early warning aircraft; 5) units are now conducting training in all types of weather conditions and at night; 6) the division or regiment commander often serves as the lead pilot; and 7) Naval Aviation and the PLAAF are gradually starting to train together from the same airfields and in the same airspace, but not in the same formations.

Naval Fighter Training

Naval Aviation’s fighters include J-7, J-8, J-10, J-11, and Su-30 aircraft. Together, their missions include engaging enemy aircraft, shooting down missiles, and attacking vessels and land targets. This section discusses various training by aircraft from each of the three fleets, to include training sequences for units assigned a new type of aircraft, training in different seasons, and training during different times of the day and in CEME conditions. It also discusses Naval Aviation’s Su-30MK2 Blue Force *fendui* (e.g., battalion-level flight group).

J-8 Transition Training

In March 2013, an NSF regiment conducted its first high-endurance, long-range tactical confrontation training event, covering several thousand kilometers and lasting in excess of three hours, and

for a model of J-8 that had only recently been allocated to a Naval Aviation unit.⁴³ The aircraft were supported by aerial tankers and AEW aircraft.

J-10 Transition Training

In July 2010, an ESF regiment received Naval Aviation's first J-10 fighters.⁴⁴ As such, the entire regiment had to start from scratch to learn how to best use the aircraft. To begin with, the regiment created a combat methods training research small group and systematically used video systems and the flight-parameter recording system (飞参) to organize every flying session. By the end of 2013, the regiment also revised over 20 training regulations, including the "Flight Training Outline" and "Handbook for Handling Special Situations".

Concerning learning new concepts, the pilots had to change from lowering their heads to see the instruments in order to see the instruments reflected on the head-up display in front of them. The first actual flights did not occur until early 2011, and they were challenged by snow and safety issues, including dealing with an aircraft that has only one engine and that often has problems, such as stalling in midair. After becoming familiar with the aircraft, the regiment began conducting low and very-low altitude defense penetration training by two aircraft with only one meter of space between the aircraft. In September 2012, the regiment conducted its first live-missile launch training against target missiles at a certain maritime area of the East China Sea. By the end of 2013, the regiment had received all of its J-10s and was fully prepared to conduct combat operations, which reportedly set a record for the shortest time to fully transition to the aircraft, to include having a fully qualified commander, several deputy commanders, flight instructors, and lead pilots, as well as staff officers in the various functional and administrative departments.

During an exercise in late 2013, pilots received a combat order, took off, covertly penetrated into the airspace above the exercise sea area, over 1,000 kilometers away, circled above the area, dove and

then climbed to a higher altitude, locked on the target, and fired four air-to-air guided missiles. All of the missiles hit their targets.

Naval Aviation Su-30MK2 “Blue Force” Fendui

Naval Aviation conducts three different types of Red vs Blue training, which can include similar or dissimilar aircraft combat training during different periods of the day. First, Naval Aviation has a dedicated Su-30MK2 Blue Force *fendui*, to be discussed below, which supposedly flies realistic copies of foreign tactics. Second, a regiment in a particular division will conduct “Red” vs “Blue” training with aircraft in its own regiment. Third, a regiment will conduct “Red” vs “Blue” training against either similar or dissimilar aircraft from another regiment in the same division or a different division. The “Blue” force in both of these cases is identified as such in name only and for the most part does not use foreign tactics.

The following analysis will focus on the Naval Aviation’s dedicated blue force, composed of Su-30MK2 fighters. In 2007, the ESF’s 4th Air Division’s 10th Air Regiment, which is also known as the Naval Aviation Heroic Eagle Regiment (海军雄鹰团), received orders to create Naval Aviation’s first “Blue Force” flight group and equipped it with the Russian-built two-seat Su-30MK2 all-weather, long-range strike fighters, shown below.⁴⁵

Figure 2: Naval Aviation’s First “Blue Force” Flight Group



Source: http://y1.ifengimg.com/79149b265eb1d598/2012/1111/rdn_509f3f211dae0.jpg

The initial pilots each had more than 1,300 hours of flight time, including approximately 300 hours as a student pilot at a flight college. The immediate challenge was to be able to collect, organize, and analyze information on the enemy's situation. At that time, there was no existing information on foreign militaries available. Unless they could get clear data, there could be no realistic imitation to speak of. They conducted research on foreign air forces and created what they considered a realistic copy of their tactics, which included being able to resist in a complex electromagnetic environment, and to be able to take off and land under marginal weather conditions. For basic training topics, such as single aircraft and formation offensive and defensive tactical maneuvers, there were several tens of sets of maneuvers. Further, almost all of the maneuvers were conducted under conditions that pushed the body to its limits. The most difficult topic in the Blue Force program was a combination of several tactical maneuvers. The program specifies that 1) each pilot is to perform this topic, 2) that each time it is performed, the pilot is not to exceed two sorties, 3) that each sortie is not to exceed an hour and a half, and 4) that there must be at least an hour and a half of rest between them.

The flight group uses up twice the amount of aviation fuel during a given period as that used by an ordinary unit. Previously, when a pilot pulled a load of three Gs, it was considered high.⁴⁶ Now, they regularly pull seven or eight Gs, which are reached instantaneously. While the old airplanes could endure such situations for several seconds, the new jets remain continuously in this state for 10 to 20 seconds. The group has specified that each pilot must become an expert in some area, study a set of combat techniques, and regularly engage in Red and Blue knowledge confrontation in the group. Through collective study in which each person prepares a topic and speaks on a maneuver and a difficult point, they mutually examine theoretical weaknesses.

In July 2011, the PLAN organized the first actual-combat confrontation between different types of fighters, what the

U.S. Air Force and Navy call Dissimilar Air Combat Training (DACT), including the Blue Force flight group, which directed the confrontation training. Because the brother units were equipped with second-generation fighters (e.g., J-7s and J-8s), the difference in fighter generations deprived the brother units of confidence. The members of the Blue Force flight group actively explained to them the performance of the third-generation fighters (e.g., J-10s and J-11s) with which they were equipped, their fighting techniques, and their operation.

Flight Commander Guidance

Fighters often receive detailed guidance from the flight commander in the tower, who is normally the regiment commander or one of the deputy commanders.⁴⁷ For example, in July 2013, fighters in an ESF regiment conducted a live-fire training exercise against an incoming missile in a complex electromagnetic environment over the East China Sea. The commander of the 44th Air Division, who was serving as the flight commander in the tower, guided a two-ship formation flown by two deputy flight group commanders. The division's political commissar was also in the tower to observe the training. Once the aircraft took off, the tower commander guided them in a tight formation, according to a pre-launch plan. In order to conceal themselves, they did not turn on their radar until they entered their attack vector and were told to do so in order to search for the incoming missile. After the lead pilot reported that the target had been detected, the tower commander quickly ordered the lead pilot to maintain his status and to search for the optimum launch opportunity. Shortly thereafter, the two aircraft received jamming, which altered their attack plan. At that time, the tower commander ordered them to change their attack method and for the wingman to peel off, implement visual attack mode, and fly towards the target from another direction. Meanwhile, the lead pilot maintained his flight status, used his onboard radar and its jamming attack mode in order to conduct counter-jamming against the jamming source.

Shortly thereafter, the lead pilot locked onto the target and fired his missile, which destroyed the incoming missile.

As noted in the paper, the PLAAF began shifting flight commanders in some, but not all, control towers from the top of the tower to the command post in the bottom of the tower. As of early 2017, there are still no signs that Naval Aviation has begun this process. Although it is not clear why Naval Aviation has not implemented this process, one possible reason is because the PLAAF is most likely using more KJ-200, KJ-500, and KJ-2000 AEW aircraft to communicate directly with its aircraft in the air, while Naval Aviation has only limited AEW aircraft.

Intercept Training

Naval Aviation aircraft have been training to intercept not only aircraft but also incoming missiles. The following paragraphs provide some examples of each type of training:

On 31 January 2014, an ESF regiment received orders to scramble two aircraft to intercept an unidentified aircraft. The on-duty room immediately went to alert level 1 (一等), and four pilots, including a flight group commander, immediately took off after receiving the order from the flight commander in the control tower.⁴⁸ As the aircraft headed toward the target, the flight commander continued to verbally provide them with vector information. At 1223, the aircraft had successfully accomplished the task and arrived home.

During 2014, the Blue Force flight group and an ESF regiment conducted several opposition-force training events together that focused on unscripted scenarios.⁴⁹ In some cases, the confrontations lasted so long and over such a long distance (over 500 kilometers) that the aircraft barely had enough fuel to return home. Rather than having the Red and Blue command posts co-located, some of the training events had them located at different bases without mutual knowledge of the other's position, and operational plans and instructions were devised and sent down on the spot. In addition, during one nighttime long-range raid, the Red Force aircraft were

only informed upon takeoff that they would be landing someplace else a great distance away and would be involved in raids and confrontation along the entire route.

During one confrontation, the lead pilot suddenly realized that his wingman had been called back by the flight commander in the tower.⁵⁰ As a result, instead of engaging 2v2, it was now a 1v2 situation, and he lost the battle. The unit used this opportunity to emphasize that this could easily become a reality during actual combat, and that the units must prepare for this situation. To prepare for this situation, the units began conducting more free air combat training. As a result, during a similar situation in mid-2014, the unit held 1v2 confrontation training. After the combat aircraft of the two sides took to the air, the Blue Force pilots relied on their radar superiorities to get the first radar lock-on. The Red Force pilots dealt with the changing situation and released interference to shake off the radar lock and, at the same time, rush at the opponent's leading aircraft at an extreme angle and fire missiles. After the opponent had been shot down, they immediately reduced altitude and formed a close-range air combat posture with the opponent's wingman.

During yet another training event, the visibility at a certain airfield along the coast in eastern Zhejiang Province was far lower than combat aircraft takeoff requirements.⁵¹ The command post, however, ordered the fighters to take off urgently, and the pilots reluctantly flew their aircraft into the skies. When two aircraft took off together, the wingman was only able to barely see the exhaust plume of the lead plane. During their return to base, as soon as the aircraft crossed the coastline, they entered the clouds and the pilots were unable to see any landmarks, so they relied on instructions from the instruments in the cockpit to successfully implement a blind landing.

Finally, several fighters were scrambled in order to shoot down an incoming missile.⁵² Upon departing, based on previous training, the pilots already had a plan in mind and knew the route of the

incoming missile by heart. Although their radars scanned, the image of the incoming missile was fuzzy and it was hard to get a lock. Suddenly, the enemy missile changed its direction and the aircraft failed to intercept it. Although the pilots felt that the rules had changed, the lesson was that they had to move away from scripted concepts to responding to unscripted situations. As a result, they began training without preconceived ideas about what was going to happen.

On 27 October 2014, Naval Aviation completed its first-ever fighter aircraft free air combat confrontational drill under unscripted conditions for research purposes that involved all three fleets and four aircraft models over several days.⁵³ It was also the first time ever for Naval Aviation to set up an airborne command post on board an AEW aircraft to guide attack missions. According to an officer-in-charge, this drill was meant to identify problems and deficiencies linked with actual-combat requirements; to further test, verify, and improve combat and training methods; and to explore ways to enhance the naval aviation force's combat strength. Throughout the research training process, participants in the drill were given total freedom to choose air battle maneuvering actions, there was no confrontational drill scheme designated in advance, there was no stipulation to designate the direction of approach, and there was no definite timing to launch attacks. The participating units were to stage electronic jamming and perform back-to-back actual confrontational drills throughout the process in accordance with the tactical requirements. All of the information was displayed on the air battle situational map in the command post, including beyond-visual-range (BVR) attacks, medium-range interceptions, and close-quarters dogfight. Concerning the pilots, they were only told about the location of the air space designated for the air battle drill, but were neither informed of their adversary's whereabouts nor what operational methods would be adopted by their adversary. In some cases, they had apparently locked onto a target already and were ready to launch a missile, but very soon afterward the adversary

managed to escape. As a result, they suddenly had to switch from offense to defense.

Anti-ship Training and Difficult Weather Conditions

In addition to intercepting aircraft and missiles, Naval Aviation fighters also train to strike enemy vessels in different weather conditions as discussed below.

During October 2014, two new-type aircraft from an NSF regiment conducted training over the Bohai Sea against an “enemy” vessel.⁵⁴ As they approached the target, they were flying fast and at very-low altitude while breaking through an electromagnetic network. Both pilots quickly climbed and broke away from each other, so that they could attack in a pincer formation by launching two missiles each from different directions. This training was only made possible because the regiment made some dramatic changes to its training methods over the previous year. Specifically, when the unit first received the new type of aircraft, one pilot was tasked to conduct a test flight at very-low altitude at night over an unfamiliar sea area for 20 minutes. However, because the weather over the sea changed abruptly that day, the pilot did not complete the flight out of consideration for safety. Based on similar events, the regiment’s efficiency rate in live-fire subject training in complex electromagnetic environments was only 58 percent.

Therefore, the regiment created a Combat Methods Theory Research Small Group, which led research on how best to change the way it conducted its training for combat methods and tactics. As a result, the regiment implemented several new training methods, including installing blackout screens in the cockpits to block 75 percent of the aviators’ field of vision during flight training in normal weather conditions, thereby artificially creating adverse weather conditions. This allowed the regiment to update its training organization model, whereby the commander is now able to adjust flight plans based on changes in the weather.

In addition, aviators are categorized into three levels—the new

aviator level, enhancement level, and actual-combat level—and flight plans are adjusted for each level. In addition, the regiment began reorganizing which training subjects should be combined during the same sortie. For example, for aviators who have completed their foundational tactical training, their flight training is organized in stages based on their actual technical and tactical level. Integrated topic training involving multiple training subjects has replaced simple training involving only one training subject.

The regiment has also combined intercept training by increasing the difference in altitude and higher speeds by two- and four-ship tactical formations coordination for integrated offensive and defensive maneuvers. The regiment has also stepped up its research effort in tactics under informatized conditions. Specifically, it has increased its reliance on omnidirectional radar warning devices and datalink information to determine target locations and to develop tactics to evade and shake off targets and go to attack locations. The regiment stepped up research of tactics for combining main and feint attacks, and flexible moves in attacking targets at sea and on land when no cover is available.

Altogether it has created more than 20 tactics for penetrating defenses and attacking targets at sea in complex electromagnetic environments. The regiment has also continually stepped up training in how to handle unusual air situations, such as ways to track small and fast moving targets. It has worked out a method for continuing aerial engagements one after another, as well as conducting focused training in patrolling vigilance, target investigation and verification, tracking and surveillance, and warning.

Striking Land Targets

Finally, Naval Aviation fighters, as well as bombers and fighter-bombers, also train to strike land targets as discussed below.

On Saturday, 7 April 2015, following an order from the division commander, several fighters from an NSF division carried out a cross-sea area, long-distance raid over the Bohai Sea, where they

conducted simulated precision strikes against different types of “enemy” land targets.⁵⁵ The goal was to be able to achieve multiple large-group, heavy-load, long-duration, very-low altitude, distant-sea assaults during any time of the day and in all types of weather conditions. To achieve this, the division spent two years building up its capabilities step by step, including creating a Maritime Training Research Small Group. Each year, the division requires all pilots to complete sea training topics of a certain length and content, with a focus on not only technical and tactical training but also on psychological training. It has allowed tactical training to be guided by the mission and tasks. As such, it has established objectives, formulated training plans, and set strict requirements regarding what to train, how to train, and how much to train. It used the training method of “first easy objectives, then difficult objectives;” “first near seas, then distant seas;” and “first adaptive training, then actual-combat training.” The unit gradually extended maritime flight time and conducted distant seas surprise attack training. This not only trained up the unit but also elevated its maritime operational ability. This series of measures effectively promoted maritime training, ensuring that the unit’s combat power steadily increased, as well as guaranteeing safety.

Summary

This section addressed the broad responsibilities for Naval Aviation fighters, including not only air-to-air intercepts at all times of day and night and in different weather conditions but also strikes against vessels and land targets at distances farther and farther from their land bases. All of this training was conducted over water. Based on the reporting from *Renmin Haijun*, Naval Aviation is becoming more adept at accomplishing these tasks; however, there is little reporting about situations where the aircraft were not able to accomplish their missions.

Naval Aviation Fighter-bomber Training

This section provides information about Naval Aviation's fighter-bomber (attack) aircraft, which consists primarily of the JH-7 Flying Leopard (飞豹) shown below.

Figure 3: JH-7 Flying Leopard



Source: <http://www.aeroflight.co.uk/wp-content/uploads/2010/02/4732.jpg>

Each of the three fleets has a JH-7 unit, who conduct similar training during different times of the year and seasonal conditions. The aircraft's primary tasks include air-to-air engagements, air-to-ship missile and bomb strikes, laying anti-submarine and anti-ship mines, and air-to-surface missile and bomb strikes against various land-based targets, including ports. To accomplish these tasks, the aircraft conduct day and night, all-weather, over-water, long-distance, and very-low and low altitude flights under radio silence and in an unscripted, complex electromagnetic environment under guidance from an airborne early warning aircraft using data links. They are also sometimes supported by fighter aircraft escorts in the same area, and oftentimes fly out of unfamiliar airfields other than their home base, including PLAAF airfields equipped with the same aircraft. During each event discussed below, the formation's lead

aircraft's rear-seat navigator provides information concerning the route and target area, while the lead pilot, who is identified as the "airborne commander," issues the order to drop the mines, launch the missiles, or fire the guns. In addition, one article about an SSF regiment noted that, to protect equipment prior to receiving the new JH-7s, the regiment's aircraft were not allowed to take off when it was raining and on pitch-dark nights.⁵⁶ All of those restrictions changed, however, when the regiment received the JH-7, such that the regiment now conducts training at nine different airfields during day and night in all types of weather conditions, including rain and fog.

From 16-17 April 2013, an NSF JH-7 unit conducted an exercise for the first time that included landing at PLAAF airfields.⁵⁷ Altogether, more than ten aircraft (e.g., probably two flight groups, each with two flight squadrons) flew more than 2,200 kilometers, used two PLAAF airfields, and conducted simulated bombing strikes against three ports and three important onshore targets distributed across three provinces, all within about six hours of time. As night fell, the aircraft departed their home base in at least two formations under radio silence and simulated dropping their first bombs 20 minutes later at low altitude at a port. At 1920 hours, the aircraft landed at a Shenyang Military Region Air Force (MRAF) base, where the PLAAF personnel conducted an inspection and maintenance tasks, as well as refueled the aircraft. At 2100 hours, they took off again and conducted their second bomb strike an hour later at a port. They then landed at a Jinan MRAF base for yet another inspection and refueling. At 2340 hours, they took off for their final strike on a different port facility. Following the attack, they returned directly to their home base, where they landed at 0210 hours. Throughout the night, they crossed over civil aviation routes and encountered changing weather conditions.

On 16 September 2013, the same NSF unit participated in the Bravery-2013 (勇敢-2013) exercise in the Yellow Sea.⁵⁸ Starting at 0915 hours, four JH-7s organized into two two-ship formations

took off, flew at low altitude, penetrated enemy naval defenses, and each group dropped two mines near “enemy” destroyers for the first time. After dropping their mines, they had to evade anti-aircraft missiles fired from the destroyers by using maneuvers and dropping chaff. The SSF held a similar exercise in August 2015 in the South China Sea.⁵⁹ Besides laying mines, this exercise also involved attacking a cargo ship and its escort destroyer and frigate.

On Sunday, 1 December 2013, six JH-7s from an ESF regiment conducted air-to-air engagements over water in two-ship formations.⁶⁰ Altogether, the exercise involved fighters, fighter-bombers, AEW aircraft, and helicopters, as well as a formation of ships. The exercise was controlled through a shore-based command post using data links. The six JH-7s took off first and were followed by a formation of J-10s, thus flying in separate echelons (梯队). While en route to the engagement zone, both groups of aircraft continually changed their formations, flight path, and altitude (low and very low) as they closed in on their targets. As they approached their target area, the weather also changed, reducing visibility. The rear seat navigator monitored the radar and guided them to the engagement area. Upon arriving in the area, the pilots then began searching visually for their targets, even though the visibility was low. The air-to-air engagement included air-to-air missiles and guns. Following the JH-7 engagements, the J-10s then engaged the “enemy” aircraft.

In August 2013, eight SSF third-generation combat aircraft (战机), whose lead pilot was the commander of the 8th Air Division, took off before dawn and conducted the first long-distance over-water strike training for the new aircraft.⁶¹ After taking off, the aircraft flew in formation through civil aircraft air routes in poor weather conditions under radio silence for over one hour at low altitude. As they approached their target, they reduced their altitude, penetrated the enemy defenses, turned on their radar, located their targets, moved into bombing formations, and, upon receiving their attack orders dropped their bombs. After leaving their target area,

they returned to an alternate airfield before flying to yet another alternate airfield before flying to their home base. As a result, the division's new fighters set a record for their first day-and-night long-range raid, with a range exceeding 2,000 kilometers, and passing through multiple airfields.

In late 2013, several JH-7s from an SSF regiment took off from deep mountains, overcame complicated weather conditions, crossed many navigation lines, flew more than two hours by crossing four provinces and autonomous regions, and carried out long-distance precision strikes against targets in unfamiliar waters some 1,600 kilometers away.⁶²

On 10 April 2014, the ESF's 6th Air Division JH-7s conducted multi-wave, multi-directional, very-low altitude, precision missile attacks against island reefs and beach positions that began at 1730 hours and lasted into the night.⁶³

In the mid-2000s, Naval Aviation JH-7s began conducting opposition-force training with naval vessels; however, the training was still new and was highly scripted.⁶⁴ Since then, Naval Aviation JH-7s have apparently participated only occasionally in opposition-force training with PLAN vessels at sea.

Summary

Naval Aviation now has JH-7 units in each of the three fleets with an overwhelming set of responsibilities, including air-to-air intercepts, air-to-ship missile and bomb strikes, laying anti-submarine and anti-ship mines, and air-to-surface missile and bomb strikes against various land-based targets, including ports. As with Naval Aviation fighters, these aircraft are increasing their training events; however, no articles discuss situations where the aircraft did not successfully accomplish their missions. As such, this implies that their training is not realistic for both the air units and for any at-sea vessels or shore-based targets involved in opposition-force training.

Naval Aviation Bomber Training

As noted earlier, Naval Aviation has a bomber unit in each fleet. Based on a review of articles published in *Renmin Haijun* from January 2013 through 2015, each unit appears to conduct the same basic types of training to 1) destroy enemy vessels by launching air-to-ship missiles against vessels or dropping bombs on them, and 2) dropping bombs on land-based targets, including harbors, docks, islands, reefs, and maritime bases. Some of the missions of bomber training within the PLAAF overlap to some extent with those of the PLA Naval Aviation. For example, bombers within the PLAAF also undertake maritime missions and training in the East and South China Seas. However, PLA naval aviation bombers train exclusively in the maritime domain, while bombers within the PLAAF train in both land and maritime domains.

This section addresses training by bombers against vessels and land-based targets, to include challenges for flying over water and looking at a “typical” training sortie designed to strike a vessel or land-based target.

A “Typical” Training Sortie

Naval Aviation bombers train in the same basic way as the other airframes. With the exception of the targets, all other aspects of the training flight are about the same. One of the biggest differences, however, is that they can conduct longer flights for longer periods of time and involve ten or more aircraft (e.g., probably two flight groups, each with two flight squadrons) flying as a group (机群) in two flight formations (编队) together.⁶⁵ For example, aircraft assigned to one SSF bomber regiment conducted a six-hour sortie that began at 1000 hours and included live bombing.⁶⁶ Naval Aviation is also now practicing more night-time, long-distance training sorties. While one flight formation’s task is to conduct a missile and bomb attack against an “enemy” vessel, the second flight formation conducts live bombing against land targets.

Launching the Weapons

As the bombers approach their target, the “enemy” begins to fire missiles and anti-aircraft artillery rounds at the aircraft. To overcome this, the bombers launch several dozen rounds of chaff to jam the radars.⁶⁷

After overcoming the “enemy’s” jamming and kinetic attacks, the bombers use on-board radar to acquire their targets. Once this is accomplished, the formation commander requests and receives permission from the ground-based or airborne command post to launch their anti-ship missiles against the “enemy” vessels from several hundreds of kilometers away or drop their bombs against land-based targets from an unidentified distance.⁶⁸ Just before dropping the bombs against the land-based targets, the formation commander orders the aircraft to pull up until they achieve the proper elevation.⁶⁹

Figure 4: Naval Aviation Bombers



Source: <http://www.janes.com/images/assets/786/46786/p1572114.jpg>

Airborne Early Warning Aircraft and Airborne Command Post Training

This section addresses training by Naval Aviation airborne early warning (AEW) aircraft and their transition to becoming

airborne command posts.⁷⁰ Of note, Naval Aviation uses the term “airborne early warning aircraft” (预警机) and the acronym AEW for its KJ-200 aircraft. It does not use airborne warning and control system (AWACS) or airborne early warning and control (AEW&C). Similar to other branches of PLA naval aviation, some of the AEW missions within the PLAAF are the same as those of the PLA Naval Aviation, with PLAAF AEW aircraft also undertaking maritime missions and training. However, the difference is that PLA naval aviation AEW aircraft train exclusively in the maritime domain, while AEW aircraft within the PLAAF train in both the land and maritime domains.

Today, the NSF’s 2nd Air Division has three subordinate regiments (4th, 5th, and 6th), whose missions include AEW, ISR (intelligence, surveillance, and reconnaissance), and ASW. Prior to 2012, these were independent regiments that were still subordinate to the 2nd Air Division.⁷¹ In mid-2010, the 4th Independent Regiment was equipped with a new model of airborne early warning aircraft (KJ-200), shown below.⁷²

Figure 5: KJ-200, Airborne Early Warning Aircraft



Source: https://en.wikipedia.org/wiki/KJ-200#/media/File:PLAAF_Shaanxi_Y-8_-_KJ200.jpg

Since the new AEW aircraft were assigned, *Renmin Haijun* has published several detailed articles about how the unit has

integrated the new aircraft, including multiple personnel and equipment challenges. It is not clear what aircrew billets besides the pilot and co-pilot are on the AEW aircraft and who fills them; however, references have been made to an airborne commander (空中指挥员), who provides guidance to combat aircraft in the air. For example, only one reference was found concerning a specific airborne commander, Zhang Xinqi (张新起), who was one of the deputy commanders of an unidentified NSF air division; however, based on a review of several articles about Zhang, he is most likely assigned to the 2nd Air Division, which has all of Naval Aviation's subordinate AEW and ISR aircraft.⁷³ Specifically, Zhang served as the airborne commander during an opposition-force training event that involved guiding "Red Force" fighters against "Blue Force" fighters.

Figure 6: Air Traffic Controllers on Airborne Early Warning Aircraft



Source: http://www.sinaimg.cn/dy/slidenews/8_img/2016_30/203_191727_713138.jpg

It appears that, when the aircraft are deployed for training with combat aircraft (fighters, bombers, and/or attack aircraft), that two AEW aircraft along with one electronic surveillance aircraft are often airborne at the same time.⁷⁴ It is not clear if AEW and

reconnaissance aircraft return home and are replaced by other aircraft after a certain number of hours during training events, or take advantage of greater endurance. Whereas the AEW aircraft conduct most of their training in the NSF area, they also deploy to the ESF and SSF to conduct training. During one training event, the aircraft departed at 2200 hours, arrived at their deployed airfield at 2400, and then began the training event at 0600 the next morning (shown below).⁷⁵

Figure 7: Airborne Early Warning Aircraft Begins Training Event



Source: <http://pic-bucket.nosdn.127.net/photo/0001/2017-10-06/D02OOVDJ4T8E0001NOS.jpg>

Until the past few years, Naval Aviation's AEW aircraft acted solely as a collection platform that gathered information and then sent it to a ground-based command post, where the flight commanders then used the information as a basis for communicating with combat aircraft in the air. Since around early 2012, however, this situation has begun to change. Specifically, the AEW aircraft have gradually been transitioning to become airborne command posts (空中指挥所). For example, in November 2013, the NSF conducted a training event that included an AEW aircraft, where division deputy commander Zhang Xinqi, discussed earlier, served as the airborne

commander.⁷⁶ During the event, the ground-based command post experienced jamming, so it turned over the command function to the AEW aircraft. The communications personnel implemented frequency-hopping and frequency-changing procedures, and the electronic countermeasures personnel carried out counter-jamming suppression. Zhang ordered the crew to start up the onboard early warning command platform system, which then turned the aircraft into the airborne operations command post.

In October 2014, Naval Aviation conducted the first and largest scale opposition-force dissimilar fighter aircraft drill employing all three fleets to include an AEW aircraft serving as an airborne command post.⁷⁷ The AEW aircraft took over responsibilities for guiding all attack missions and worked in conjunction with ground-based radars and the ground-based command post. The training event served as a research tool for increasing the aircraft's involvement as a command post to further test, verify, and improve operational and training methods. Throughout the research training process, participants in the drill were given total freedom to choose air battle maneuvering actions, there was no confrontational drill scheme designated in advance, there was no stipulation to designate the direction of incidence, and there was no definite timing to launch attacks. The participating units were to stage electronic jamming and perform back-to-back actual confrontational drills throughout the process, in accordance with the tactical requirements.

On the real-time air battle situational map displayed in the AEW aircraft's command post, the airborne commander saw a huge information net formed by land-based radars and airborne early-warning aircraft, which worked side by side.⁷⁸ The screen showed beyond visual range (BVR) attacks, medium-range intercepts, and close-quarter dogfights. In addition, arrowhead signs followed by lines, representing air battle paths, were interwoven on the map. For the participating units, the drill was not scripted. The units were only told about the location of the airspace designated for the air

battle drill but not their exact location. As the engagement began, the two sides exchanged back and forth from offense to defense.

Command carried out by the AEW aircraft is different from that taking place on the ground.⁷⁹ An airborne commander is able to promptly assess the situation in the air and give the orders to attack or to take cover accordingly. The integrated command platform is the one single factor that affects an airborne commander's flexible assessment and handling of the situation as it unfolds. In the past, the integrated command platform and aircraft-carried information systems were not used too often, so the establishment of data links was less successful, resulting in the regiment's growth of combat capabilities being stunted in operations requiring the use of information systems. In the training program implemented in 2012, the AEW aircraft implemented a higher use of data links. Today, the AEW aircraft airborne commander analyzes the situation and sends guidance (引导) or command and guidance (指挥引导/指引) to each relevant flight formation through data links.⁸⁰ After being guided to the right area, the fighters approached the "enemy" and receive orders from the airborne commander to attack.⁸¹

In addition to guiding fighters during air engagements, the AEW aircraft use data links to guide bombers and attack aircraft for strikes against surface vessels.⁸² To accomplish this, the AEW aircraft provides information about the vessels' location and any active air defenses and radar systems. It also guides them through the defenses and issues the order to launch the missile attack when appropriate. For example, in February 2013, an NSF [fighter-bomber] regiment conducted a training event jointly with an AEW unit to develop attacks against vessels.⁸³ Shortly after taking off, the situation changed, such that the lead pilot for two formations flying together, who is called the airborne commander (空中指挥员), received information from a data link from the AEW aircraft and took over command of the attack by guiding the other aircraft in the formations to lock onto an enemy ship for precision strike. By using a data link system, the regiment is able to connect the

airborne commander with the AEW aircraft command post and ground-based command post, as well as all other combat units, for more flexible command execution closer to the site of actual combat.

Summary

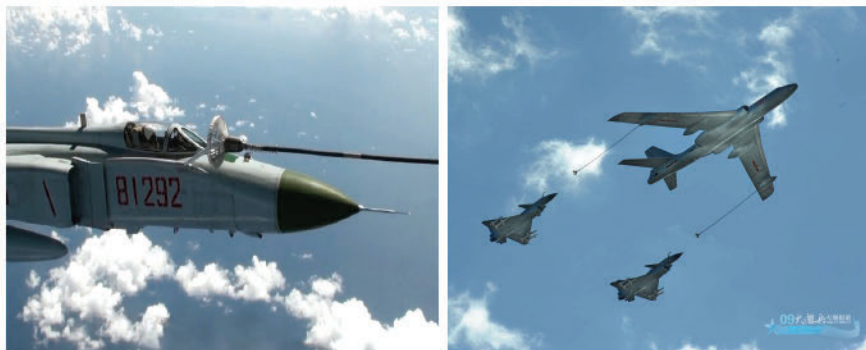
Since both Naval Aviation and the PLAAF have only recently begun to allow personnel on their AEW aircraft to communicate directly with fighter, fighter-bomber, and bomber aircraft in the air, the information in this chapter is valuable as a window into this new concept. It will most likely take some time for all components of Naval Aviation to become comfortable with this new concept, particularly in the context of operations under CEME conditions and at increasingly further distances from the coast.

Naval Aviation Air Refueling Training

This section addresses Naval Aviation aerial refueling capability. To date, the limited number of H-6 tankers in each of the three fleets can only refuel specific versions of the J-8 and J-10 fighters.⁸⁴ In early 1996, an SSF H-6 bomber regiment was tasked to create a small H-6U tanker subunit (分队) by converting some of its aircraft to aerial refueling tanker versions.⁸⁵ Although the order was received in 1996, it took four years to prepare the unit to successfully conduct its first long-distance, over water refueling training in September 2006.⁸⁶ Some units, however, did not even begin aerial refueling training until 2009 and 2010.⁸⁷

Today, all three fleets have been able to keep fighters aloft for two to three times the normal amount of time and conduct long-range fighter engagements over water by conducting aerial refueling.⁸⁸ In some cases, the tanker and fighters are vectored to each other through communications with an AEW aircraft.⁸⁹

Figures 8 and 9: Aerial Refueling



Source: *Renmin Haijun*, 17 June 2010, p. 1 and 28 September 2010, p. 1, respectively.

Concerning the *Liaoning* aircraft carrier, in mid-2014, Naval Aviation J-15's apparently conducted “buddy store” in-flight refueling, where one fighter receives fuel from another fighter.⁹⁰ A buddy refueling capability is certainly important for the PLAN's ability to conduct flight operations at extended distances from shore but the offload capacity of a fighter is limited, particularly if it does not carry external fuel pods.⁹¹ Additionally, every fighter tasked with tanking duty removes a fighter from combat operations, not a minor consideration on a small carrier with a limited air group.

Figure 10: J-15 “Buddy Store” Refueling



Source: http://i1054.photobucket.com/albums/s489/themiddlepath1/Military/202353hf5m7olf43rti5lj_zps940bd10f.jpg

In addition, in early January 2016, the PLA released a video showing that a Su-30 fighter jet was being refueled by an IL-78 air-refueling aircraft.⁹² According to the posted information, *Jane's Defense Weekly* reported in November 2014 that China had received at least one IL-78 tanker plane from Ukraine out of three that it had ordered in 2011. It is not clear, however, if the tankers will support the PLAAF and/or Naval Aviation. Finally, China is supposedly developing a Y-20 aerial refueling aircraft, but it has not yet entered service.⁹³

Summary

The bottom line here is that Naval Aviation, like the PLAAF, conducts only minimal air refueling due to a lack of refueling aircraft and the types of aircraft that can be refueled in the air. Of particular interest is the growing interest to be able to refuel carrier-borne fighters.

Naval Aviation Helicopter Training

This section provides information about Naval Aviation helicopters, which are assigned in each of the three fleets. They apparently share the same airfield with fixed-wing aircraft. While the helicopters are assigned to shore-based units, they deploy aboard various vessels, including destroyers, frigates, and corvettes. In some cases, however, they are identified as shipborne helicopter regiments (e.g., embarked helicopters) (舰载机团).⁹⁴ Their primary tasks are anti-submarine warfare (ASW)-related, including dipping sonars into the water and firing air-launched antisubmarine torpedoes, as well as medical rescue support.

One of the challenges for Naval Aviation is landing on various vessels in all types of sea and weather conditions. For example, the training task of landing on a moving ship is highly difficult but is also greatly practical in actual operations.⁹⁵ Such skill plays an

important role in the collaborative operations between helicopters and ships. In May 2013, for example, one ship-based helicopter regiment arranged high-intensity flight training for new pilots under “special sea conditions” completing 180 sorties, highlighting the increasing importance of training for landings on moving ships under sub-optimal sea conditions.

Although helicopters are assigned to various vessels, they are often not able to operate due to poor sea conditions. For example, during the “Maneuver-5” (机动-5) exercise in the Western Pacific in October 2013, the task forces had to deal with Typhoon Francisco, which involved strong wind force of 6 or 7 and strong waves of four to six meters high.⁹⁶ As a result of the poor sea conditions, the shipborne helicopters could not take off, so the vessels had to rely on their own ASW systems to detect the submarines.

In addition, landing on a vessel at night has always been a challenge. Although the first helicopter landing on a ship took place on 3 January 1980 outside the mouth of the Yangzi River, most units did not routinely conduct night training until the early 2000s.⁹⁷ However, new vessels are initiating training as early as possible. For example, the Bengbu Type 056 Jiangdao-class of corvette was commissioned in February 2013 and conducted its first night helicopter sorties in December 2013.⁹⁸

Besides flying off of vessels, some Naval Aviation helicopters conduct their ASW missions from their home airfield. They also deploy to other airfields, where they then conduct their maritime tasks.⁹⁹

Depending on the type of vessel, up to three helicopters of various types can conduct coordinated missions. For example, in April 2014, the ESF's Fuzhou destroyer simultaneously deployed three helicopters of different types, which was the first time for any destroyer to accomplish this.¹⁰⁰

In June 2013, an NSF Naval Aviation helicopter regiment was involved in the first joint military-civilian rapid-repair mobilization drill at a civilian airfield on the Shandong Peninsula that had been struck by “enemy” munitions.¹⁰¹ The drill used the National Defense

Mobilization Law as its foundation. A single helicopter was used to evacuate injured personnel from the airfield to relevant hospitals. In addition, in April 2014, a helicopter on the Fuzhou destroyer rescued a sailor who had fallen overboard.¹⁰²

Summary

Naval Aviation has both shipborne and land-based helicopters, whose primary missions are ASW-related. As noted in the section, however, helicopter training has had a long, difficult stretch involving flying in poor sea conditions, at longer distances, and at all times of the day. Although not discussed in the section, Naval Aviation has deployed multiple helicopters aboard vessels involved in the 23 escort missions in the Gulf of Aden since 2008. As such, Naval Aviation has learned a lot about how to operate in far seas conditions for lengthy periods of time. For example, in March 2011, a warship operating under NATO's Operation Open Shield (OOS) provided helicopter gunfire assistance to a US warship working under CTF-151 to arrest a group of pirates attempting a hijack.¹⁰³

Naval Aviation Combined-Arms, Joint, and Combined Training

This section addresses Naval Aviation combined-arms training with the other PLA Navy branches, joint training with the PLAAF, and combined training with foreign militaries. It also briefly discusses flying multiple types of aircraft from the same airfield for what the PLA also considers joint operations. One of the biggest challenges, however, is terminology. According to the U.S. Department of Defense Dictionary of Military and Associated Terms (JP 1-02):

- Combined arms refers to the full integration and application of two or more arms or elements of one Service into an operation (JP 3-18)

- Joint connotes activities, operations, organizations, etc., in which elements of two or more Military Departments participate (JP 1)
- Combined is a term identifying two or more forces or agencies of two or more allies operating together (JP 3-16).

Unfortunately, although the PLA uses “combined arms” (合成/合同) for two or more branches in the same service, it uses the term “joint” (联合) to express each of the three categories—combined arms, joint, and combined. Therefore, for purposes of this paper, the U.S. military equivalent will be used for each category.

Combined-Arms Training with other Naval Branches

In May 2013, the NSF conducted a combined-arms naval aviation and surface vessel exercise over the Yellow Sea and Bohai Sea. The exercise included over 70 aircraft, including fighters, fighter-bombers, and AEW and reconnaissance aircraft, from three provinces and involved more than 300 sorties over a three-day period starting at 0820 hours on the first day.¹⁰⁴ AEW and reconnaissance aircraft detected, identified, and tracked targets and guided fighter-bombers for strikes against ship formations and ports, and guided fighters against aerial targets and vessels. While the fighters conducted their attacks against vessels and separately intercepted enemy fighters in the Bohai Sea, the fighter-bombers conducted their bomb strikes in the Yellow Sea, both of which occurred in a complex electromagnetic environment created by the enemy vessels. Upon landing, the aircraft were quickly inspected and refueled before taking off again for a follow-on strike that lasted until after 2100 hours each day. While four air units carried out training from daytime to nighttime, two air units executed flights after midnight. During the exercise, several destroyers equipped with helicopters were also involved, in the Yellow Sea. However, this exercise was different from previous ones, because the helicopter pilots were all new. As such, four pilots were assigned to land on a

ship for the first time. Altogether, they completed 180 sorties and each pilot conducted 45 ship landings.

On 16 September 2013, Naval Aviation fighter-bombers and naval vessels conducted a daytime combined-arms live-force naval mine warfare drill identified as “Bravery-2013” (勇敢-2013) in the Yellow Sea.¹⁰⁵ The Blue Force, played by two destroyers, set up an anti-submarine blockade area, waiting for an opportunity to destroy a Red Force submarine. To counter this, the Red Force sent four fighter-bombers divided into two formations at low altitude to lay mines. Twenty minutes later, the first group of combat aircraft successfully dropped two new-model naval mines into the designated sea area; however, the destroyers also launched surface-to-air missiles against the aircraft at the same time. Although the battle was scheduled for two hours, it lasted seven hours. On the next day, the scenario began at 0400 hours and involved naval minesweepers eliminating mines that the enemy vessels had laid.

In the early winter of 2013, Naval Aviation fighters, bombers, and AEW aircraft teamed up with a formation comprised of PLAN destroyers and frigates in the Yellow Sea to conduct a Red vs Blue confrontation exercise under unknown conditions, in multidimensional space, and in a complex electromagnetic environment.¹⁰⁶

Throughout the exercise, the aircraft shuttled back and forth and at other times circled around awaiting orders. Throughout the exercise, the Red Force AEW aircraft was implementing real-time early warning detection of the air situation in the given region. The airborne commander on the AEW aircraft was Zhang Xinqi (张新起), discussed in Section 6. Within the rear compartment of the aircraft, various operational elements were quickly transmitting air situation information analysis and judgments ascertained from the onboard equipment back to the land-based command post. When the AEW aircraft began to suffer electromagnetic jamming of its radar and communications, communications personnel implemented frequency-hopping and frequency-changing procedures, and

electronic countermeasures personnel carried out anti-jamming suppression. Several minutes later, everything returned to normal, but jamming immediately blocked all land-based radar systems and communications with the land-based command post. As a result, the AEW aircraft suddenly became an airborne command post. Zhang Xinqi then issued orders to one of the fighter formations to descend to low altitude, implement radio silence, maneuver to a certain airspace, and then to intercept and attack the target. It took 17 minutes from the time the jamming began until Zhang ordered the aircraft to attack.

During August 2015, the SSF conducted a combined-arms training drill involving surface vessels and Naval Aviation.¹⁰⁷ The scenario centered on sinking a Blue Force cargo ship and heavily damaging the destroyer and frigate that were escorting it. While AEW aircraft guided the fighter-bombers and bombers toward the target, Blue Force aircraft were also scrambling to engage them. As a result, the Red Force scrambled its own fighters to provide escort for the AEW aircraft. Meanwhile, both sides engaged in jamming and counter-jamming, and the Blue Force launched missiles at the Red Force aircraft. In the end, the Red Force sank the cargo ship, one destroyer, and one frigate, and the mission was accomplished satisfactorily.

In late October 2015, an unknown number of J-11s from the SSF's 8th Air Division along with unidentified PLAN surface vessels and possibly other aircraft conducted an exercise over the South China Sea in response to U.S. naval activities in the area.¹⁰⁸

Based on available photos, the J-11s apparently deployed to Woody Island (aka Yongxing Island) in the Paracels for an unknown period. In addition, in late February 2016, U.S. intelligence spotted J-11s and JH-7's on Woody Island.¹⁰⁹

Joint Training with the Army and Air Force

The PLAN Naval Aviation appears to be increasing its joint training with the PLA Army and Air Force. In early September

2013, warplanes and vessels from the ESF conducted a joint island landing campaign training event with aircraft from the Nanjing MRAF.¹¹⁰ The training was the culmination of 12 years of joint interaction between PLAN surface warfare officers and naval aviation personnel, as well as with PLAAF personnel. When the event kicked off, the ESF Naval Aviation commander, Rear Admiral Sun Laishen, issued orders through the integrated combat command platform in Zhejiang Province. Combat aircraft of different models subordinate to Naval Aviation and the PLAAF subsequently took off in multiple batches, formed formations, and made a rush maneuver to a destination 500 kilometers away. This case set a precedent for a PLAN-directed hybrid grouping of combat aircraft from different services as well as surface vessels. Along the coast of Fujian Province, surface units of the fleet fought side-by-side with units from different war theaters in a joint island-landing operation drill. Senior Captain Jin Hang, commander of the 5th Landing Ship Zhidui,¹¹¹ was in command of a “three-dimensional landing operation,” which was seen as an epitome of the development further in depth of the joint operation pattern over a 12-year period.

From 5 to 7 August 2014, the PLAN's Qingdao Support Base successfully led research and training during an exercise in jurisdictional area joint defensive operations in an area of the Yellow Sea off of *Liaoning* Province.¹¹² This was just the next step in a process that began in 2012. The training event involved the Shenyang Theater Command (e.g., Shenyang Military Region)¹¹³, an electronic countermeasures regiment subordinate to the 39th Group Army, four air brigades subordinate to the PLAAF's Dalian Base, a Shenyang MRAF radar brigade, and NSF frigate and Naval Aviation units, as well as police and militia forces. The command post at Qingdao included representatives from each component. The scenario focused on defending against enemy attacks by conducting intercepts, executing a circuitous attack, and jointly blocking and destroying any enemy surface and subsurface vessels. The Naval Aviation assets included fighters for air intercepts and two AEW aircraft, as well as shipborne helicopters for anti-submarine tasks.

Although Naval Aviation and PLAAF AEW and ISR aircraft apparently operate occasionally in the same AOR, such as the East China Sea, no information was found about Naval Aviation and PLAAF fighters, fighter-bombers, or bombers working together jointly against the same target; however, the following two items discuss opposition-force training with similar and dissimilar aircraft that began in 2014.

On Saturday, 23 August 2014, the ESF 4th Air Division's 10th Air Regiment, identified earlier as the Naval Aviation Heroic Eagle Regiment and only dedicated "Blue Force" *fendui*, conducted Naval Aviation's first ever joint free air combat opposition-force training with the Air Force.¹¹⁴ Both sides flew out of a PLAAF base. Whereas the PLAAF used the Chinese-produced J-11, the Eagle Regiment used the Su-30MK2 to engage in 1v1 and 2v2 free air combat at different altitudes. The unidentified Air Force unit was the first one to receive the J-11 and had competed in the annual Golden Helmet competition from 2011 onwards. Naval Aviation's pilots represented the "Blue Force" and the PLAAF pilots from an unidentified unit in the Nanjing MRAF represented the "Red Force." The first event began at 0700 hours when two aircraft squared off in 1v1 free air combat. The two Naval Aviation pilots included Eagle Regiment commander Chen Gang in the front seat and deputy regiment commander Fan Wenjun in the rear seat. The two Air Force pilots included deputy regiment commander Yan Feng in the front seat and flight group commander Wang Li in the rear seat. Yan and Wang had competed together in the Golden Helmet competition, and Yan is one of only three pilots who have won the award twice from 2011 through 2015. In the end, Chen and Fan, who trained for this event for five months, won the engagement by using clouds as cover and fired a missile from behind. Although the engagement was free air combat, both aircraft received vectoring via data link from their respective ground-based command posts. Following this engagement, other pilots then conducted 2v2 intercepts. All intercepts also included jamming and counter-jamming.

Finally, on 2 November 2015, the Guangzhou MRAF organized the “Sharp Sword-2015” (利劍-2015) actual-combat joint exercise over the South China Sea that included PLAAF and Naval Aviation fighters, fighter-bombers, bombers, airborne early warning and control aircraft, reconnaissance aircraft, and helicopters.¹¹⁵ The primary units involved Guangzhou MRAF and Naval SSF units. The only specific aircraft that were identified were PLAAF H-6K bombers and J-11s. According to Rear Admiral Yin Zhuo (尹卓), who is the Director of the PLAN Informatization Expert Advisory Committee, “the PLAAF has long assumed the responsibility of homeland defense. It mainly attacks fixed targets on the ground and is not familiar with situations at sea. Navy Aviation units are mainly responsible for striking more elusive targets moving at sea. Owing to many special conditions, such as complex weather, indistinguishable sea and sky lines, and the like, it is much more difficult to identify targets at sea. These are exactly the areas falling short in PLAAF experiences. Through joint operation exercises, the Air Force gets to know the combat environments at sea better. Furthermore, with the support of the Air Force, Naval Aviation will be able to seize command of the air (制空权)¹¹⁶ over a large area more easily in times of war. Specifically, ‘Seizing command of the air is the first thing to do in any war. Only when one has command of the air, can its aircraft carrier, large-sized destroyers, and submarines give play to their tremendous capabilities to attack seaborne and ground targets’.”¹¹⁷

Summary

Whereas the PLAAF is conducting increasing combined-arms, joint, and combined training, Naval Aviation is considerably behind in joint and combined training. Its primary combined-arms training involves helicopters and surface vessels. As noted in the section, it has only recently begun to conduct joint training, most of which is opposition-force training, with the PLAAF.

Although the PLAAF and Naval Aviation have conducted some joint training, only one example for 2013 and 2014 was found, which implies they do not routinely train together or against each other. Furthermore, the competition between the Naval Aviation and PLAAF pilots clearly indicates they trained for several months for a single event, which most likely took away from their meeting all of their annual requirements.

3. Carrier-based Aviation Training and Development

PLA Navy Carrier-based Aviation Training and Development

On 25 September 2012, China commissioned into service its first aircraft carrier -- the *Liaoning* (hull number 16) -- a vessel that China purchased from Ukraine as an unfinished ship in 1998 and later refurbished at the Dalian Shipyard in Liaoning Province.¹¹⁸ As of this writing, it is not clear exactly which fleet or which leader-grade hierarchy the *Liaoning* is subordinate to. More than likely, it is directly subordinate to the Operations Department in the PLAN Headquarters' Headquarters Department in Beijing.

The commissioning of an aircraft carrier has the capacity to impart a new dimension of naval and naval aviation capabilities for China. An aircraft carrier, for example, gives the PLAN the ability to operate far from China's shores to protect overseas assets and interests. If history is any guide, however, the process of honing the skills necessary to undertake sustained carrier operations will be a long and arduous process with many challenges ahead for the PLAN.¹¹⁹

The *Liaoning* is a conventionally-powered carrier with an estimated full load displacement of 60,000 tons and can accommodate an eventual air wing¹²⁰ of 25 to 30 aircraft, including fixed-wing airplanes and helicopters.¹²¹ The *Liaoning* uses a STOBAR (short take-off but arrested recovery) system for launching and recovering aircraft, which severely restricts the weight of aircraft before launch, which in turn limits the fuel and ordnance load that an aircraft can carry. By comparison, the *USS NIMITZ* is a 100,000-ton, nuclear-powered aircraft carrier, giving it greater endurance than the *Liaoning*, and can accommodate an air wing of 60 fixed and rotary

wing aircraft. The NIMITZ launches its fixed-wing aircraft over both the ship's bow and angled deck using a CATOBAR (catapult assisted take-off but arrested recovery) system, giving aircraft being launched from it a range and payload capability much greater than aircraft employing a STOBAR system. The *Liaoning*, like a U.S. Navy aircraft carrier, lands fixed-wing aircraft using arresting wires on its angled deck.

Thus, even when fully operational, the *Liaoning* will not enable long-range power projection similar to U.S. Nimitz-class carriers. The *Liaoning's* smaller size limits the number of aircraft it can embark, while the ski-jump configuration restricts fuel and ordnance load. The *Liaoning* is therefore best suited to fleet air defense and anti-submarine warfare missions, extending air cover over a fleet operating far from land-based coverage and is most likely a "starter" carrier meant to train pilots and crews for subsequent aircraft carriers the PLAN plans to construct.¹²²

Aviation Training for Carrier Operations

Since the system for training Chinese pilots in carrier-based aviation is relatively new in China, the institutions within the PLAN oriented towards carrier-based aviation training remain underdeveloped and evolving.¹²³ For the *Liaoning*, it appears the PLAN selected the most seasoned pilots within the Naval Aviation corps as the first group of pilots to undergo carrier-based aviation training. Going forward, the PLAN will, in all likelihood, adopt a long-term approach of recruiting cadets and building a carrier-based aviation corps from the ground up.

Generally speaking, there are three stages of carrier-based aviation education and training that naval aviation pilots around the world must proceed through: 1) pilot trainee selection, 2) pre-operational carrier-aviation education and training, and 3) carrier-based aviation training and operations. Concerning PLA Naval Aviation aircraft carrier pilots, cadets must go through a rigorous process of theoretical

study at the Naval Aviation Engineering Academy and Naval Aviation Academy and receive their bachelor's degree before transitioning to the practical application (实际操练) phase of land-based training as a new officer.¹²⁴ Once land-based training has been mastered, the new pilot trainees transition to carrier-based training, which begins the second stage of "pre-operational carrier-aviation education and training." This stage involves field carrier landing practice (FCLP), ("touch-and-go's" on land) and eventually landings and take-offs from the deck of the aircraft carrier. This stage is called "pre-operational" because training occurs before the aircraft carrier is fully operational and before an air wing is assigned to the carrier. As of this writing, it appears that the current batch of Chinese carrier-based aviators has progressed through the second stage of "pre-operational carrier-aviation education and training" and have just begun the third stage of "carrier-based aviation training and operations."

According to the PLAN, the third stage of "carrier-based aviation training and operations" consists of pilot training upon assignment to a "carrier-borne aviation unit" (舰载航空兵部队) that is part of an "aircraft carrier battle group" (航母编队).¹²⁵ As such, carrier-based aviation operations include training across a range of tactical and operational scenarios, to include emergency landings, nighttime flying, command and control with the carrier battle group-based and airborne early warning-based commanders, air defense penetration, and flying during adverse weather conditions, among other tasks. This stage of pilot development can last decades and exposes naval aviators to all forms of operational and weather-related challenges he or she may encounter.

Based on reporting from *Renmin Haijun* and *Kongjun Bao*, China's naval and air force newspapers, it has taken roughly ten years from initial recruiting of carrier-based aviators for China to successfully deploy an air wing-sized cohort of pilots for carrier operations. This appears to be a relatively expedited timeline of training, compared to the US navy experience, which took much longer to train and deploy its first crop of pilots for carrier operations.¹²⁶

The first step in China's carrier-based aviator selection and training commenced in September 2006, when the PLAN selected candidates from the "best flying units across the country."¹²⁷ The chosen pilots had more than 1,000 hours of flight time under their belts, including more than 500 hours in a third-generation aircraft.¹²⁸ Of this group, one-third came from the PLAN's "Naval Aviation Heroic Eagles Regiment" (海空雄鹰团), one of China's most storied aviation units, with roots dating back to 1956.

One *Renmin Haijun* article, which featured the "Heroic Eagles" training program for carrier-based training, stated that the unit began trials in J-11B-variant trainers for roughly four years until the PLAN introduced the carrier-based J-15 variant, called the "flying shark" (飞鲨), in March 2010.¹²⁹ According to Chinese media reports, between 2010-2012, pilots reportedly undertook "greatly accelerated" land-based training in order to begin carrier-based aviation trials, at that time set to take place around the end of 2012. One *Renmin Haijun* article noted that pilots averaged forty flights a month, flying twenty-one days a month, and achieved over 8,600 land-based take-offs and landings in total during the two-year stretch.¹³⁰

Although the exact date is uncertain, pilots appear to have begun a series of touch-and-go sea trials on the deck of the *Liaoning* near the end of the land-based segment of training, most likely at the beginning of 2012, in preparation for China's first arrested-recovery landing aboard a carrier. Then on the morning of 23 November 2012, Dai Mingmeng (戴明盟) became the first Chinese pilot to successfully land an aircraft on an aircraft carrier in the Bohai Sea.¹³¹

Dai's successful landing initiated the final component of "pre-operational carrier-aviation training" – carrier-based training – occurring from December 2012 to the end of 2015. Based on Chinese reporting, it appears sea trials involving aviation training of J-15 fighters took place two to three times a year on average, involving four to six J-15 fighters, with each successive trial increasing in intensity, difficulty of training tasks, and number of sorties.

Figure 11: Pre-operational J-15 Takes Off From Land-based Ski Jump Runway During Training



Source: http://blogs.plymouth.ac.uk/dcsc/wp-content/uploads/sites/50/2015/09/xlarge_J-15_LIA-ONING.jpg *The yellow paint indicates pre-operational status of the aircraft.*

Figure 12: Operational J-15 Takes Off From Liaoning During Training



Source: <http://en.people.cn/n/2015/1010/c98649-8960296.html> *The grey paint depicts the fact that the aircraft has achieved operational status.*

China's first carrier-borne aviation unit was formally established on May 10, 2013.¹³² Upon establishment, the PLAN began sea trials involving training of the aviation unit. For example, starting on June 30, 2013, for example, China undertook a 25-day training deployment in the Bohai Sea of the *Liaoning* during which pilots executed "several days of continuous take-off and landing exercises."¹³³ Importantly, instead of returning to their land-based airfields from which they departed, pilots and their planes for the first time stayed aboard the carrier to test the ability of the carrier crew, pilots and mechanics to operate at sea. The training resulted in the "certification" (航母资质认证) of China's first group of pilots

and deck crew for aircraft carrier operations.¹³⁴ In September 2013, the *Liaoning* reportedly undertook its second round of sea trials involving aviation training in the Bohai Sea. During the tests, the J-15 took off from land-based airfields and practiced landings and take-offs aboard the carrier at sea. Pilots completed over 100 sorties, to include taking-off with “maximum payloads” and “multi-weapon configuration” take-offs and landings.”¹³⁵ From November to December 2013, the *Liaoning* undertook a 37-day training mission off of Hainan Island, reportedly the first time the *Liaoning* had been deployed to the South China Sea.¹³⁶ During the trials, the *Liaoning* reportedly “underwent a comprehensive test of its combat system and conducted a formation practice,” and this marked the first time the *Liaoning* was deployed as an aircraft carrier battle group, shown below, that consisted of several surface vessels, including two destroyers and two frigates, as well as an unknown number of submarines during the drills.¹³⁷ The extent of naval aviation training was not reported, however.

Figure 13: Liaoning Carrier Strike Group Exercise



Source: http://media.ws.trib.ir/image/4bhgc23a3ff6c31s5g_800C450.jpg

By April 2015, naval aviation training aboard the *Liaoning* reportedly had become “routinized” (模式化), with pilots flying

in “adverse weather” conditions and undertaking “all types of tactics training, munitions loads take-offs, and emergency landing scenarios.”¹³⁸ Also, during the April 2015 training, several J-15 pilots reportedly spent “more than a few nights aboard the *Liaoning*,” marking the longest period of time removed from shore-based logistics and sustainment for both pilots and aircraft.¹³⁹ By the end of 2015, the PLAN reported it had successfully certified a batch of carrier-based pilots (航母资质认证) in “all segments of naval aviation requirements,” bringing a total of four batches of six pilots, or 24 in total, theoretically trained and prepared for carrier-based operations.¹⁴⁰

Finally, from December 2016 through January 2017, the *Liaoning* embarked on its longest deployment at sea, participating in its first carrier battle group (CVBG). The group first navigated the Bohai Sea before sailing through the East and South China Seas and then transiting through the Taiwan Strait before returning to its port in Qingdao.¹⁴¹ During the voyage, PLAN naval aviation launched and recovered dozens of J-15 sorties, to include the launching of air-to-air and air-to-ground missiles as well as mid-air refueling in the process of training.¹⁴² The voyage represented the induction of China’s first operational air wing into the PLAN.¹⁴³

While there is speculation that a J-31 variant may be introduced as a next generation carrier-based fighter to replace or augment the J-15 “Flying Shark,” reporting on the J-15’s eventual replacement remains speculative at best.¹⁴⁴

Unresolved Questions and Challenges Ahead for PLAN Naval Aviation

To support future carrier capabilities, China is now challenged with establishing a comprehensive support infrastructure and institutions to train, equip and sustain carrier-based naval operations. The corollary to such operations might be what the U.S. Navy refers to as “Naval and Air Training and Operating Procedures

(NATOPS).¹⁴⁵ It must develop training, logistics, and maintenance pipelines. It must also develop operational infrastructure, including command and control. One *Jiefangjun Bao* (PLA Daily) article hinted at the challenges ahead for China's carrier program when it highlighted the long and unglamorous process of training a cadre of carrier-based aircraft deck crew, mechanics, hanger storage operators, and fuel and ammunition operators.¹⁴⁶

Furthermore, China has just begun the process of establishing the institutions necessary to recruit and train the future generation of naval aviation pilots. One Chinese article revealed that the current ratio between the pilots and aircraft within the PLAN was about 1.5:1 -- meaning that for every one naval aviation aircraft, China has trained an average of 1.5 pilots to fly that aircraft -- highlighting a severe gap in the current generation of naval aviators.¹⁴⁷ How much time China's navy devotes to training land-based aviators in carrier-based operations, for example, will illustrate the extent to which China perceives carrier-based aviation as a marginal or primary component of China's overall naval aviation development, and the strategic value of, and goals for, carrier-based aviation. Given the large size of China's land-based tactical naval aviation arm, it is probably not practical for the PLAN to require all of its fighter and fighter-bomber pilots to train as carrier aviators; but determining the appropriate ratio of carrier trained versus not carrier trained will be a challenge for the PLAN in the coming years.

Not only will China have to train more pilots, but it will have to absorb the losses of hundreds, if not thousands of pilots within the course of carrier-based aviation operations. The issue was brought to our attention in a recent (and rare) *Xinhua News* report which revealed that two Chinese naval pilots had died in a "training accident" related to the *Liaoning*.¹⁴⁸ This is no doubt the first of many more to come for China. Between 1949, when the U.S. Navy began deploying jets to aircraft carriers on a large scale, and 1988, for example, the Navy and Marine Corps lost almost 12,000 aircraft and more than 8,500 aircrew.¹⁴⁹ Even if China decides to adopt a more

moderate pace of training and operations, it is almost certain to suffer significant pilot and aircraft losses as it builds up its carrier capability.

Additionally, the concept of an integrated CSG will impart new challenges for the PLAN not accustomed to training and devising war plans based on carrier task forces. The support and protection of carriers involve a complex coordination among submarines, surface combatants and air assets that will require a complete reorganization of the PLAN's organizational structure. Chinese naval aviators in particular will be required to coordinate with other branches and platforms within the PLAN and CSG that for China are still very much in flux due to the infancy of China's carrier program. Based on Chinese reporting of PLAN training, China has yet to manage the intricacies of coordination with the PLAAF, submariners, AEW platforms, and within the larger integrated CSG air defense system that established navies have had decades to work through.

Finally, it is not clear how the aircraft that fly off of the *Liaoning* will be organized and which land-based unit they will be subordinate to or if a whole new structure will be created. It is worth noting then when a US Navy carrier is in port in San Diego, Norfolk, or Bremerton, its squadrons are often scattered around the country at bases hundreds of miles away. Specifically, are they organized into a typical air regiment that has 18-24 airframes and further organized into battalion-grade flight groups and subordinate company-grade flight squadrons? The same holds for the shipborne helicopters. In addition, whereas Naval Aviation and PLAAF aircraft have 5-digit tail numbers, all photos of the carrier-based J-15s show them with only a 3-digit tail number.

4. Overall Assessment

While not considered an expeditionary force capable of far seas operations, PLA Naval Aviation has evolved from its traditional role of coastal defense to being able to undertake a broader portfolio of tasks consisting of naval fleet air defense, maritime patrol, anti-submarine warfare, maritime strike against land targets and vessels, logistical support, airborne early warning, and helicopter support for the PLAN. However, until it develops a full-fledged aircraft carrier capability, to include accompanying surface and subsurface task forces, PLA Naval Aviation is and will remain largely a land-based force. Land-based naval aviation forces are inherently limited by the maximum range of the aircraft deployed by the PLAN, which, in turn, limits some roles and missions one typically expects naval aviation fleets to fulfill.

Despite such constraints, PLA Naval Aviation has steadily increased the types, intensity and scope of its training subjects and scenarios in an effort to maintain readiness and support broader PLAN operations within and beyond the first island chain. These include increasing combined-arms and joint training exercises (both within the PLAN and with different services of the Chinese military) flying under challenging environmental conditions, such as at night and in extreme weather patterns; flying at low altitudes, flying under complex electromagnetic environments, and cultivating elements of free air combat and autonomy among naval aviators with decreased altitude restrictions; and conducting bomber and reconnaissance aircraft missions beyond the first island chain in the Western Pacific. The overall aim of these training tasks is to mimic actual naval battle conditions that a potential military adversary may present.

While the *Liaoning* may not enable long-range power projection capabilities similar to those of U.S. carriers, the *Liaoning* and its

eventual successor carriers will impart an altogether new component of naval and naval aviation operations. In the short to medium term, China will seek to train a new generation of carrier-based aviators, logisticians, and deck maintenance personnel, which, based on the U.S. Navy experience, will require a significant commitment of time, manpower and budgets. By all accounts, it appears China is committed to developing this capability in the long-term.

Although this paper, which is primarily based on information from the PLA Navy's newspaper, points out several shortfalls that Naval Aviation has identified, rarely is there an article that states that a training mission failed. It is highly unlikely that all of the aircraft that depart to attack a vessel, port facility, or land-based air defense site, or to engage in close-in air-to-air combat, will succeed and/or return home safely. Furthermore, there are virtually no articles that indicate their home bases are also under enemy attack or that they have to sustain operations for long periods of time. Finally, there is little information that discusses how Naval Aviation and the PLAAF could or would divide up a particular air space, such as the East China Sea Air Defense Identification Zone (ADIZ) that was created in November 2013, or a possible new ADIZ in the South China Sea.

Appendix A: Naval Aviation Operational Air Order of Battle

Appendix A provides a brief history of the types of aircraft Naval Aviation has had along with a current list, as well changes to the air order of battle.

Naval Aviation Aircraft

During the 1950s, Naval Aviation consisted primarily of the Tu-2, La-11, and MiG-15bis aircraft. By 1960, the force comprised 500 aircraft, mostly MiG-17 (J-5) and MiG-19 (J-6) fighters and Il-28 (H-5) light jet bombers.¹⁵⁰ During the 1980s, Naval Aviation began acquiring the J-7. During the 1990s, Naval Aviation was the first PLA aviation units to receive the J-8-2 and JH-7 combat aircraft. Today, Naval Aviation consists of the following aircraft, which are primarily land-based; however, the J-15 is now flying off the *Liaoning* aircraft carrier, and helicopters routinely fly off of various surface ships. Naval Aviation also has apparently deployed certain types of shore-based unmanned aerial vehicles (UAVs).¹⁵¹

- Fighters: J-7, J-8, J-10, J-11, and J-15
- Bombers: H-5 and H-6
- Fighter-bombers (attack): JH-7, Su-30
- Seaplane: SH-5
- Transports, AEW, and reconnaissance aircraft: Y-7, Y-8
- Helicopters: Z-5, KA-28, Z-8, and Z-9
- Unmanned aerial vehicles.

Naval Aviation Air Order of Battle

Note: This report covers the period of 2013-2015. Although multiple changes have occurred since the PLA began its

reorganization in early 2016, the changes have not been incorporated into this report.

A review of Chinese publications indicated that, by the end of the 1960s, Naval Aviation had created nine divisions and three independent regiments.¹⁵² In 2003, Naval Aviation consisted of 25,000 personnel and about 800 total aircraft organized into eight air divisions and 27 regiments, of which several were independent regiments.¹⁵³ Today, there does not appear to be a single, authoritative unclassified air order of battle for Naval Aviation, which different sources report as ranging from six to nine air divisions plus several independent regiments. According to the annual U.S. Department of Defense Annual Report to Congress on the PLA, Naval Aviation has a total of six unidentified air divisions, including two in each of the three fleets. According to the March 2015 Directory of PRC Military Personalities, the six divisions are listed by fleet as shown below; however, the types of airframes and subordinate regiments are not identified:¹⁵⁴

- North Sea Fleet: 2nd and 5th air divisions
- East Sea Fleet: 4th and 6th air divisions
- South Sea Fleet: 8th and 9th air divisions

In addition, *Renmin Haijun* has multiple articles about an unidentified regiment equipped with Y-8 transports that is directly subordinate to the PLA Navy Headquarters Department (海司某飞行团). Although no specific mission for this unit is identified, some of the articles reference activities concerning health and epidemic prevention (卫生防疫) and earthquake relief (抗震救灾) operations.¹⁵⁵

According to *Modern Chinese Warplanes: Combat Aircraft and Units of the Chinese Air Force and Naval Aviation*, Naval Aviation has the following six operational air divisions and subordinate regiments:¹⁵⁶

North Sea Fleet

- 2nd Air Division (3 regiments) with AEW, Seaplane, and ISR aircraft, as well as helicopters
- 5th Air Division (3 regiments) with JH-7 fighter-bombers and J-8 fighters

East Sea Fleet

- 4th Air Division (3 regiments) with J-10 and Su-30 fighters and various helicopters
- 6th Attack Division (3 regiments) with JH-7 fighter-bombers and H-6 bombers
- A UAV reconnaissance dadui (e.g., battalion-level group, which is most likely treated as a regiment)

South Sea Fleet

- 8th Air Division (3 regiments) with J-7 and J-11 fighters, and H-6 bombers
- 9th Air Division (3 regiments) with J-8 fighters, JH-7 fighter-bombers, and various helicopters.

Of note, although the PLAAF began creating about 15 air brigades since early 2012 by abolishing air division headquarters and upgrading air regiments, it does not appear that Naval Aviation has followed suit. In addition, whereas most PLAAF airfields have a single type of airframe, it appears that Naval Aviation has several airfields with multiple types of airframes. In addition, whereas the PLAAF began moving its senior officers from the control tower to the command post in the bottom of the control tower and replacing them with other officers identified as “flight adjusters” (飞行调配员) it does not appear that Naval Aviation has done the same thing.

Endnotes

¹ The PLA Navy uses Naval Aviation (海军航空兵), which does not have an acronym. It does not use PLA Naval Air Force (PLANAF).

² Yao Jun, ed., *A History of China's Aviation* (中国航空史), Zhengzhou: Dajia Publishers, September 1998, p. 183-189.

³ "Naval Aviation Branch of the CPLA" (中国人民解放军海军航空兵部), in Zhao Yiping, ed., *China People's Liberation Army History* (中国人民解放军军史) Second Edition Volume 3, China Encyclopedia Press, December 2007, p. 543-544. The protocol order can be found at <http://eng.mod.gov.cn/ArmedForces/navy.htm>.

⁴ Gao Xiaoxing, *The PLA Navy*, China Intercontinental Press, January 2012, p. 92-94.

⁵ "Naval Aviation Branch of the CPLA" (中国人民解放军海军航空兵部), in Zhao Yiping, ed., *China People's Liberation Army History* (中国人民解放军军史) Second Edition Volume 3, China Encyclopedia Press, December 2007, p. 543-544.

⁶ *China's National Defense* (中国的国防) has been published biennially from 1998 through 2015 by the PRC State Council's Information Office. This publication is usually referred to as the Defense White Paper (白皮书). Only the 2002 and 2012 versions discuss the PLAN's missions.

⁷ Gao Xiaoxing, *The PLA Navy* (English version) Beijing: China Intercontinental Press, October 2012, p. 100.

⁸ Wang Xugong and Yuan Hongchao, "Naval Aviation" (海军航空兵), in Zhang Fujiang and Zhang Hui, eds., *China Navy Encyclopedia* (中国海军百科全书), Beijing: Haichao Press, December 1998, p. 429-430.

⁹ Roderick Lee, *The People's Liberation Army Navy Naval Aviation Branch: A Mission Analysis of Naval Aviation and What It Is Supposed To Do*, unpublished master's course paper at George Washington University, 29 April 2013.

¹⁰ However many of these latter missions are not overtly emphasized in doctrinal writings, we assess these missions do exist based on the types of training activities conducted and the types of aircraft employed.

¹¹ *Renmin Haijun*, 1 April 2009.

¹² Wang Houqing, Zhang Xingye, eds., *Science of Campaigns* (战役学), Beijing: Military Science Press (军事科学出版社), May 2000, p. 433. Zhang Yuliang, ed., *Science of Campaigns* (战役学), Beijing: Military Science Press (军事科学出版社), May 2006, p. 364.

¹³ World Military Yearbook 1987, p. 10, identified Naval Aviation as having subordinate SAMs, but no yearbooks since then broke out the subordinate units. Furthermore, the 5 and 10 September 2002 issues of RMHJ, which covered Naval Aviation's 50th anniversary, noted subordinate AAA and radar units, but did not list SAMs, nor did any RMHJ articles note SAM units since then. Chen Zhe, Zhu Weijun, and Zhu Ya, "Young Officers and Enlisted Personnel in a North Sea Fleet Naval Aviation's Certain Air Defense Brigade Move Forward", *Renmin Haijun*, 24 October 2014, p. 4. Yan Shuofeng, Zhong Jijun, and Shao Longfei, "A South Sea Fleet's Certain Air Defense Brigade," *Jiefangjun Bao*, 23 July 2012.

¹⁴ Zhu Rongchang, ed., *Air Force Dictionary* (空军大辞典), Shanghai: Shanghai Dictionary Press, September 1996, p. 168–168. PLA Air Force Officer Handbook, 2006, p. 338. Liu Xiaolian and Yu Qingliang, *PLA Air Force Female Pilots* (中国人民解放军空军女飞行员), Beijing: Blue Sky Press, August 2012.

¹⁵ See Kenneth W. Allen, "PLA Air Force, Naval Aviation, and Army Aviation Aviator Recruitment, Education, and Training," Jamestown Foundation, March 2016, accessed at http://jamestown.org/uploads/tx_jamquickstore/PLA_Aviator_Recruitment_Education_and_Training_Final_01.pdf.

¹⁶ Mao Zhi, Lu Jing'an, and Gao Hongwei, "In Darkness, War Hawks Skim the Seas to Launch Sudden Attacks," *Renmin Haijun*, 24 April 2014, p. 2. Of note, every unit in the PLA down to the company level has at least two deputies.

¹⁷ In the PLAAF and Naval Aviation, pilots are awarded one of four grades—third grade (三级), second grade (二级), first grade (一级), and special grade (特级)—as they move up their career ladder and wear the appropriate wings on their uniform. The criteria for acquiring these grades include having flown X number of safe flying hours based on the type of airframe, conducting special missions, serving as a lead pilot for 2-, 3-, and 4-ship formations, serving as a flight controller in the tower, serving as a flight instructor, and having the ability to fly day and night IFR and VFR missions in all types of weather conditions.

¹⁸ Zhou Shiwei and Gao Hongwei, "A Certain Bomber Regiment Under the South Sea Fleet Aviation Forces Breaks Barriers to Open Up a Path for Winning," *Renmin Haijun*, 10 April 2013, p. 1. Zhang Tao and Li Binfu, "Airborne Command Post Makes Attacks Quick and Accurate – Information on North China Sea Fleet Naval Aviation Live Troop Confrontation Drills," *Renmin Haijun*, 26 November 2013, p. 2. Zhang Tao and Li Binfu,

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“Airborne Command Post Makes Attacks Quick and Accurate – Information on North China Sea Fleet Naval Aviation Live Troop Confrontation Drills,” *Renmin Haijun*, 26 November 2013, p. 2.

¹⁹ Mao Zhi, Lu Hao, and Gao Hongwei, “Aerial Bombs Grow Eyes,” *Renmin Haijun*, 7 May 2014, p. 2.

²⁰ Note: The PLAAF and Naval Aviation do not have a term for ground controlled intercept (GCI). Although the PLA has a term for command and control (指挥控制), it is primarily focused on higher level commanders providing command and control to units. Command and guidance is more directed at commanders giving guidance to specific components of their unit, such as a commander in a tower providing guidance to a pilot in the air. *Military Terminology of the Chinese People's Liberation Army* (中国人民解放军军语), Beijing: Academy of Military Science Publishing House, 2011, p. 183-184.

²¹ Zhang Dabin, Mao Zhi, and Gao Yi, “Long-Distance Raid: Storming Fortifications on a Bombing Run,” *Renmin Haijun*, 27 April 2015, p. 1.

²² Zhang Dabin and Gao Yi, “Night Training Says Goodbye to ‘Calm Wind and Waves,” *Renmin Haijun*, 18 May 2015, p. 3.

²³ Mao Zhi, Lu Jing'an, and Gao Hongwei, “In Darkness, War Hawks Skim the Seas to Launch Sudden Attacks,” *Renmin Haijun*, 24 April 2014, p. 2.

²⁴ Xu Yeqing, Zhao Haitao, and Zhang Heng, “Boldly Charging Through Multiple ‘Off-Limit Areas’ in Troop Training -- A Certain Flight Regiment of the East Sea Fleet Practices Combat Effectiveness Standards During Live Combat-Oriented Training,” *Renmin Haijun*, 27 October 2014, p. 2.

²⁵ Wang Chaowu, “PLA Navy’s First Jian-10 Flying Regiment Sets Many Records for Re-equipping-related Training,” *Renmin Haijun*, 13 December 2013, p. 2.

²⁶ *People's Liberation Army Air Force 2010*, National Air and Space Intelligence Center (NASIC), August 2010, p. 84, which was accessed at http://www.au.af.mil/au/awc/awcgate/nasic/pla_af_2010.pdf.

²⁷ Zhang Dabin and Gao Yi, “Night Training Says Goodbye to ‘Calm Wind and Waves,” *Renmin Haijun*, 18 May 2015, p. 3.

²⁸ Zhu Rongchang, ed., *Air Force Dictionary*, page 728. Yao Wei, ed., *China Air Force Encyclopedia* (中国空军百科全书), Beijing, Aviation Industry Press, November 2005, Vol 2, p. 800.

²⁹ Gao Yang and Yang Aiguo, "In the Dark of Night, Twenty-Four Bombs Fly Toward the 'Enemy' Position - A Certain East Sea Fleet Aviation Regiment Closely Follows Actual Combat in Organizing an Assault Exercise," *Renmin Haijun*, 17 June 2014, p. 1.

³⁰ Zhang Dabin and Gao Yi, "Night Training Says Goodbye to 'Calm Wind and Waves'," *Renmin Haijun*, 18 May 2015, p. 3.

³¹ Zhang Dabin and Gao Yi, "Night Training Says Goodbye to 'Calm Wind and Waves,'" *Renmin Haijun*, 18 May 2015, p. 3.

³² Jin Diwei and Wang Chaowu, "Build Intensive Joint Operation Support Platform -- Record of An Unidentified Station of East Sea Fleet Naval Aviation Enhancing Capability Building of Comprehensive Support for Multiple Aircraft Types," *Renmin Haijun*, 16 April 2013, p. 3.

³³ Ibid.

³⁴ Kou Yongqiang, Li Yimin, and Li Xuefeng, "Take Off From the Runway Under Conditions of Actual Combat -- An Eye-Witness Account of the Efforts Made by a South Sea Fleet Division To Enhance Its Capability To Provide Comprehensive Support to Multiple Types of Aircraft," *Renmin Haijun*, 26 February 2014, p. 3.

³⁵ Li Dongdong, "Elevation of Combat Alert Status Without Delay: East Sea Fleet Naval Aviation Regiment Combat Readiness Duty Connects Seamlessly With Regular Training," *Renmin Haijun*, 23 April 2013, p. 2.

³⁶ Yin Kunze, Xu Xiaosai, Zhang Heng and Zhao Haitao, "Freestyle Air Combat, In Pursuit of the Real Meaning of Fighting Winning Wars -- Record of Contemplations on a Certain Regiment of East Sea Fleet Navy Aviation Holding Live Combat Oriented Training," *Renmin Haijun*, 16 September 2014, p. 2.

³⁷ Zhou Shiwei and Gao Hongwei, "A Certain Bomber Regiment Under the South Sea Fleet Aviation Forces Breaks Barriers to Open Up a Path for Winning," *Renmin Haijun* 10 April 2013, p. 1.

³⁸ Zhang Tao and Li Binfu, "Airborne Command Post Makes Attacks Quick and Accurate -- Information on North China Sea Fleet Naval Aviation Live Troop Confrontation Drills," *Renmin Haijun*, 26 November 2016, p. 2.

³⁹ Mao Zhi, Lu Hao, and Gao Hongwei, "Aerial Bombs Grow Eyes," *Renmin Haijun*, 7 May 2014, p. 2.

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⁴⁰ Mao Zhi, Lu Jing'an, and Gao Hongwei, "In Darkness, War Hawks Skim the Seas to Launch Sudden Attacks," *Renmin Haijun*, 24 April 2014, p. 2.

⁴¹ Elizabeth Shim, "Chinese navy pilots survive fighter jet crash," UPI, 17 December 2015, accessed at www.upi.com/Top_News/World-News/2015/12/17/Chinese-navy-pilots-survive-fighter-jet-crash/9961450409131/. Zhang Tao, ed., "PLA Navy aircraft in flight training crashes," China Military Online, 18 December 2015, accessed at http://eng.mod.gov.cn/DefenseNews/2015-12/18/content_4633081.htm. http://eng.mod.gov.cn/DefenseNews/2015-12/18/content_4633081.htm.

⁴² Zhang Tao, "Navy fighter crashes in east China," Xinhua, 12 May 2016, found at http://eng.mod.gov.cn/DefenseNews/2016-05/12/content_4656751.htm.

⁴³ Miao Zhengge and Wang Songqi, "Attack, Attack, and Attack Again -- A Snapshot of a Navy Fighter Plane's Training to Maintain its Endurance and Range," *Renmin Haijun*, 29 March 2013, p. 1.

⁴⁴ All of the information in this subsection on J-10 transition training comes from Zhang Qingbao, Wang Chaowu, and Zhao Haitao, "The Fierce Dragons Attack -- Record of Enhancing Capabilities for Winning War by Unidentified Regiment of the East Sea Fleet Naval Aviation Corps," *Renmin Haijun*, 9 July 2013, p. 1, and Wang Chaowu, "PLA Navy's First Jian-10 Flying Regiment Sets Many Records for Re-equipping-Related Training," *Renmin Haijun*, 3 December 2013, p. 21.

⁴⁵ All of the information in this subsection on the Blue force came from Liang Qingsong, Fang Lihua, Dai Zongfeng, Jin Diwei, and Zhang Heng, "The Ace Takes Charge -- A Report From the First Flight Group of a Certain Regiment of East Sea Fleet Naval Aviation on Enhancing the Ability to Fight and Win Battles," *Renmin Haijun*, 26 March 2014, p. 4. Liu Wenping, Zhao Haitao, and Ju Zhenhua, "Flying against a 'Golden Helmet'," *China Armed Forces* magazine, in Chinese and English, No. 32, Vol 2, 2015, p. 80-83. Zhao Haitao and Zhang Heng, "Lay Firm Foundation for Joint Training, Deepen Degree of Joint Operation, and Raise Joint Combat Capability; Navy Will Jointly Organize with Air Force Free Air War Confrontation Drill," *Renmin Haijun*, 20 August 2014, p. 1. The photo of the Heroic Eagle Regiment was accessed at http://y1.ifengimg.com/79149b265eb1d598/2012/1111/rdn_509f3f211dae0.jpg. "China East China Sea Fleet Su-30 fighters revealing what," 2 April 2016, found at <http://www.get-top-news.com/news-11998571.html>.

⁴⁶ <https://answers.yahoo.com/question/index?qid=20101126111755AA9pCa7>. Pulling "g" (e.g., gravitational effects) is basically pulling back on the stick forcing a change in the flight path of the plane. The harder and more rapidly you pull, the higher the "g" is. Every "G" is the equivalent of 1 times the force of gravity, such that each "g" adds the amount of your weight (e.g., a 175 pound person would weigh 350 at 2 g's and 525 pounds at 3 g's, etc.). This type

of “g” is referred to as positive “g” because it adds to the weight of the pilot were he placed on a scale. Negative “g” is pushing forward on the stick. The pilot’s weight would be reduced. Military pilots regularly fly maneuvers at 4 “g”s. All acrobatics involve using up to 4 “g”s. Higher “g” tolerances may be tolerated if the pilot wears a “g” suit which looks like a pair of pants with cut-outs for the knees. Anything beyond 8 “g”s is very difficult to tolerate very long. Negative “g”s max out around 3, because they cause terrible headaches for the pilot. 0 “g” is weightlessness. On the way to negative “g” the pilot will pass momentarily through 0 “G”. The US Air Force has experienced several pilot deaths as a result from snapping on high “g” loads and the pilot passing out. The “g” load drops and the pilot begins to wake up.

⁴⁷ Wang Zhengyang, Liu Hugang, and Zhang Heng, “Two Aircraft Go Out on the Attack, Target Missile Explodes High in the Sky,” *Renmin Haijun*, 2 August 2013, p. 1.

⁴⁸ Zhang Heng, Jin Diwei, and Zhao Haitao, “Combat Aircraft From the ‘Naval Aviation Heroic Eagle Regiment’ of the East China Sea Fleet Take- Off As Soon As the Siren Sounds,” *Renmin Haijun*, 8 February 2014, p. 1.

⁴⁹ Xu Yeqing, Zhao Haitao, and Zhang Heng, “Boldly Charging Through Multiple ‘Off-Limit Areas’ in Troop Training -- A Certain Flight Regiment of the East Sea Fleet Practices Combat Effectiveness Standards During Live Combat-Oriented Training,” *Renmin Haijun*, 27 October 2014, p. 2.

⁵⁰ Ibid.

⁵¹ Ibid.

⁵² Ibid.

⁵³ Yin Kunze, Fang Lihua, and Zhang Heng, “Fighter Planes Belonging to the Navy’s Three Fleets Participate in an Air Battle Confrontational Drill for Research Purpose,” *Renmin Haijun*, 29 October 2014, p. 1.

⁵⁴ Kang Zhijun and Yan Fujiang, “Gaining Combat Power From Innovating Tactics,” *Renmin Haijun*, 29 October 2014, p. 3. Note: The Bohai Sea is also identified as the Bohai Gulf.

⁵⁵ Wang Leilei and Zhao Jingyuan, “PLA NSF Division: Honing Cross-Sea Area Long Distance Assault Capability,” *Renmin Haijun*, 13 April 2015, p. 1. Of note, only two specific references were found concerning flight activity on a Saturday.

⁵⁶ Fu Xiangpeng, Yu Maoqiang, and Li Xuefeng, “Eagle Strikes at Sea and Heaven -- Record of a Certain Flying Group Under the South China Sea Fleet Naval Aviation That Raises Core Military Capabilities,” *Renmin Haijun*, 4 July 2014, p. 3.

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⁵⁷ Qi Weiyue, Mi Jinguo, and Wang Qinghou, "A Certain Flight Regiment of the North Sea Fleet -- 'Pin-Point Elimination' in an All-Nighttime Long-Range Raid Exercise," *Renmin Haijun*, 3 May 2013, p. 1.

⁵⁸ Ma Jijun and Huang Liang, "Breathtaking Combat as Assaults Are Launched in 'a Sea of Naval Mines' -- Witnessing the 'Bravery-2013' Live-Force Naval Mine Warfare Drill," *Renmin Haijun*, 30 September 2013, p. 1.

⁵⁹ Zhou Shiwei and Gao Hongwei, "Many Aircraft Coordinating, Hacking At an Obstinate Enemy in the Clouds: South Sea Fleet Aviation Organizes Multi-Branch Joint Opposition-force Training Exercise," *Renmin Haijun*, 11 August 2015, p. 2.

⁶⁰ Fang Lihua, Zhao Haitao, and Zhang Heng, "Eyewitness to East Sea Fleet Aviation Organized Multiple Aircraft Type Combined Attack Live-Forces Live-Ammunition Training Exercise," *Renmin Haijun*, 6 December 2013, p. 1. Of note, this was the only reference found for flight activity occurring on a Sunday.

⁶¹ Wen Xiangyan, Wang Dan, and Gao Hongwei, "Long-Range Raid: Clouds and Moon on a Distant Road," *Renmin Haijun*, 28 August 2013, p. 2.

⁶² Fu Xiangpeng, Yu Maoqiang, and Li Xuefeng, "Eagle Strikes at Sea and Heaven -- Record of a Certain Flying Group Under the South China Sea Fleet Air Force That Raises Core Military Capabilities," *Renmin Haijun*, 4 July 2014, p. 3.

⁶³ Wan Yateng, Li Zhiwu, and Huang Binbin, "Very Low Altitude Defense Penetration," *Renmin Haijun*, 25 April 2014, p. 1.

⁶⁴ "NSF Naval Aviation Regiment Conducts Combined Training with Surface Task Force; Reflects 2005 Goals of Developing and Perfecting Combined Air-Surface Operational Capabilities, Tactics" *Renmin Haijun*, 12 March 2005, p. 1.

⁶⁵ The photo at the right was accessed at http://news.sina.com.cn/china/2000-3-10/70284_a3.jpg and is representative of most photos showing Naval Aviation bombers in formation.

⁶⁶ Zhang Dabin, Mao Zhi, and Gao Yi, "Long-Distance Raid: Storming Fortifications on a Bombing Run," *Renmin Haijun*, 27 April 2015, p. 1.

⁶⁷ Zhang Dabin, Mao Zhi, and Gao Yi, "Long-Distance Raid: Storming Fortifications on a Bombing Run," *Renmin Haijun*, 27 April 2015, p. 1. Zhang Dabin and Gao Yi, "Night Training Says Goodbye to 'Calm Wind and Waves'," *Renmin Haijun*, 18 May 2015, p. 3.

⁶⁸ Mao Zhi, Lu Jing'an, and Gao Hongwei, "In Darkness, War Hawks Skim the Seas to Launch Sudden Attacks," *Renmin Haijun*, 24 April 2014, p. 2. Gao Yi, Li Xiao, Liang Qingsong, Zhang Qingbao, and Li Gaojian, "The Sword Is Pointed at the Ocean and the Bow String Is Being Pulled – An Account of the Distant-sea Actual-Troop Opposing Force Exercise 'Maneuver-5' (机动-5)," *Renmin Haijun*, 28 October 2013, p. 1. Gao Yang and Yang Aiguo, "In the Dark of Night, Twenty-Four Bombs Fly Toward the 'Enemy' Position – A Certain East Sea Fleet Aviation Regiment Closely Follows Actual Combat in Organizing an Assault Exercise," *Renmin Haijun*, 17 June 2014, p. 1.

⁶⁹ Mao Zhi, Lu Hao, and Gao Hongwei, "Aerial Bombs Grow Eyes," *Renmin Haijun*, 7 May 2014, p. 2.

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¹¹⁷ Qiu Yue: "Expert: Joint Navy and Air Force Exercise Boosts Strength to Seize Air Supremacy and Gives Play to the Navy's Ability To Attack; Chinese Air Force's H-6K Bombers Take Part in 'Sharp Sword-2015'[Lijian-2015] Real-Troop Exercise". *Renmin Wang*, 4 November 2015,

¹¹⁸ For more on the *Liaoning*, see Andrew S. Erickson, Abraham M. Denmark, Gabriel Collins, "Beijing's "Starter Carrier" and Future Steps: Alternatives and Implications," *Naval War College Review*, Winter 2012.

¹¹⁹ The United States Navy, for example, struggled for decades and suffered thousands of losses as it trained aviators on the first USN operational fighter jet, the F1 Phantom, in 1947. Robert C. Rubel, "The U.S. Navy's Transition to Jets," *Naval War College Review*, Spring 2010.

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¹²⁴ See Kenneth W. Allen, “PLA Air Force, Naval Aviation, and Army Aviation Aviator Recruitment, Education, and Training,” Jamestown Foundation, March 2016, accessed at http://jamestown.org/uploads/tx_jamquickstore/PLA_Aviator_Recruitment_Education_and_Training_Final_01.pdf.

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¹²⁶ In a panel at the "EAST: Joint Warfighting 2013" symposium in Virginia Beach, Va., for example, Vice Admiral Ted Branch, who at the time was commander of the U.S. Navy's Atlantic air arm and is now Director of Naval Intelligence, said that China would most likely "learn faster than we did and they will leverage our lessons." See Sam LeGrone, "Two PLA Pilots Have Died Testing Fighters for Chinese Carrier," *USNI News*, 5 September 2014; See also Capt. Matt Portz, USNR, (Ret.), "Aviation Training and Expansion, Part 1," *Naval Aviation News*, July-August 1990; and Robert C. Rubel, "The U.S. Navy's Transition to Jets," *Naval War College Review*, Spring 2010.

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¹²⁸ Ibid.

¹²⁹ Wang Hui, Deng Ranzi, Ding Yubao, Cai Nianchi, and Liang Qingsong, "Practical Efforts to Support Aircraft Carrier Dream, Part 4: I Piloted a Warplane on the Aircraft Carrier -- Reports From Aircraft Carrier-Based Fighter Test Pilots" [实干托举航母梦4: 我驾战鹰上航母 -- 来自航母舰载战斗机试飞员的报告] *Renmin Haijun*, 28 January 2013.

¹³⁰ Wang et. al., "Practical Efforts to Support Aircraft Carrier Dream" *Renmin Haijun*, 28 January 2013. The article notes, for example, that pilots experienced a great deal of "pressure and risk" in undertaking test flights of the carrier-based J-15 variant, which had not undergone the typical duration of safety and inspection tests.

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¹³² "Entering China's First Carrier-Borne Air Force," [走进中国首支舰载航空部队] *China Armed Forces* No 21, Vol. 3 2013, p. 16-39

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¹⁴¹ "The *Liaoning* ship returns – a review of seven classic moments of its epic voyage," *Dangdai Haijun*, 13 January 2017. On the transit through the Taiwan Strait, see Michael Forsythe and Chris Buckley, "Taiwan Responds after China Sends Carrier to Taiwan Strait." *The New York Times*, 10 January 2017.

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